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# USSR Report

ENERGY

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## USSR REPORT ENERGY

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OIL AND GAS

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ROLE OF ECONOMISTS AT INDUSTRIAL ENTERPRISES REVIEWED

Moscow NEFTYANOYE KHOZYAYSTVO in Russian No 11, Nov 84 pp 3-8

[Article: "Raising the Efficiency of Petroleum Production - An Important Problem for the Economic Services"]

[Text] In May 1984, in Saratov an All-Union industrial conference was convened on the subject "Ways of increasing the use of the principal assets, saving labor and material resources, and increasing the efficiency of petroleum production as a whole". The conference was organized by the Ministry of the Petroleum Industry, the Central Committee of the trade union of workers of the oil and gas industry, the Central Board of the NTO NGP [The Scientific and Technical Society of the Oil and Gas Industry] imeni I. M. Gubkin, and the Saratovneftegaz association. The managers and leading specialists of the economic services of the oil producing associations, of scientific organizations, and the central staff of the Ministry of the Petroleum Industry took part in the conference.

Included in the program of the conference were the most urgent matters of the economics of the enterprises of the petroleum industry connected with the realization of the decisions of the December 1983 and the February and April 1984 Plenums of the CPSU Central Committee. The conference participants devoted principal attention to the problem of carrying out the appeal of the December Plenum to increase the productivity of labor above the plan by one percent and additionally to lower the cost of production by 0.5 percent.

Reports were heard by V. I. Grayfer of the Planning and Economic Administration of the Ministry of the Petroleum Industry on the basic directions of the work of the economic services, by A. K. Merkushev of the Central Committee of the Trade Union on the role of the trade union committees in the mobilization of the labor collectives and the scientific and technical communities for raising the efficiency of oil production, by N. P. Makarov of the Administration for the Organization of Labor, Wages, and Worker Cadres of the Ministry of the Petroleum Industry about improving the use of labor resources, and by P. F. Chernov of the Accounting Administration about monitoring the use of principal assets and material resources. Other reports were heard and also communications from the managers of the economic services of several of the associations about the measures being taken to assure above-plan increases in the productivity of labor and lowering the cost of production.

The urgency of the conference was connected with the situation which had built up in the petroleum industry before the completion of the plan for the first half of the fourth year of the 11th Five-Year Plan. This situation is best characterized by words from the speech of the General Secretary of the CPSU Central Committee, K. U. Chernyenko, at the April 1984 Plenum: "We have gone beyond the extremely important boundary of a five-year plan when the counting goes by months. At the same time, the situation is not at all such as can be managed without a further increase in the intensity of our economic work."

The production of oil from January to April 1984 was below the plan with the supplemental assignment. Of course, the occasion for anxiety by the workers of the industry is extremely well founded. The Ministry took specific steps to liquidate the lag and clear off the indebtedness; however, individual associations are not coping with the assignments. The difficulties arising in the industry urgently require a fundamental improvement in the activities of the enterprises and associations. The role of the economic services in this business is especially significant. In the light of modern demands, the economist in the petroleum industry cannot be simply a person analyzing the actual indicators that have been recorded and passively planning the indicators for future periods proceeding from "bases" formed by the data on an enterprise over several years. Meanwhile, rather frequently economists - accountants, financiers, planners and workers on labor and salary - describe their work as the concluding stage of all the efforts of a labor collective for improvement of the technology and organization of production.

This perception is erroneous. Actually, in the search for ways to increase the productivity of labor and lower the cost of production, the economist must begin with a study of the unused potentials for increasing the efficiency of production as an important condition for the solution of the problem. He is obliged to expose unused potentials and to evaluate the effectiveness of their use, first of all from an economic position, and then join in the work for the realization of the potentials with specialists on the technology and organization of production. In fact, the economist should be at the head of this work, considering it as his very first duty.

In modern conditions when, for assuring the effectiveness of the economy, the principal thrust has been put on increasing the level of management and more fully utilizing the production potential and the material, financial and labor resources, the deciding word belongs to the economist who, before others, should see the practicable directions for achieving the projected goals.

Let us consider the indicator of the productivity of labor. For the industry the plan for this index since the beginning of 1984 has been overfulfilled by 100.1 percent, including, for April 1984, by 101 percent. In so doing, however, the obligation of the Ministry of the Petroleum Industry for the four months was fulfilled not by one percent but by 0.1 percent despite the fact that 12 associations had overfulfilled their plans for the productivity of labor by 2.3-5.6 percent, and 12 associations by 1-1.9 percent. Some associations are the principal reason for the arrears in oil production.



Of the two ways of achieving the projected level of labor productivity (the output of supplementary production or the release of workers) the Ministry of the Petroleum Industry has completed measures only for the reduction of labor expenditures. As a consequence, the principal direction should become a more effective utilization of oil and gas producing capacity, mainly the stock of wells. The solution of this problem depends on several factors; namely, advancing the introduction of new wells into exploitation from the time of their drilling, a maximum acceleration of the introduction of inactive wells, a curtailment of the periods of idleness of wells, and providing for the optimum condition for their exploitation.

Such work is being done in the associations but its results are not identical. In some of them the number of producing wells found in all kinds of idleness exceeds standards because of unsatisfactory organization of routine repairs and technical servicing. For instance, other production associations, especially Bashneft, have convincingly showed that the level of utilization of the principal stocks of oil fields can be substantially increased even with only the available technical means and material and labor resources. For this, advantage should be taken of the valuable experience of the NGDU [Oil and Gas Producing Administration] Arlanneft which has been recommended for general introduction by the board of the Ministry of the Petroleum Industry.

Other production associations also have positive experience. Characteristic for it, as a rule, is a comprehensive approach where the carrying out of technical and organizational measures combine with improved methods for incentives for labor, savings of resources, curtailment of operational expenditures, and so on. Workers of the economic services should carefully investigate the experience of others to take from it for their own enterprise the solutions which really increase the efficiency of production.

The brigade method of labor organization, its introduction and improvement, and the extraction of the maximum benefits from collective forms of labor should occupy a special place in the work of economists.

The Ministry of the Petroleum Industry attaches extremely important significance to the development of the brigade forms of labor organization. At the industry's enterprises 7800 brigades are functioning. Of them, 47 percent are comprehensive, 70 percent work on a common order, and 53 percent distribute piece-work extra pay and bonuses on the basis of the coefficient of labor participation (KTU).

The coverage of workers by the brigade forms of organization amounts to 70.3 percent and will grow in the future. This, however is not everything. The main thing is that each brigade should represent a strong coordinated collective with a precise group of responsibilities and assignments and with the pay of the labor according to the final result and with the distribution of wages according to the contribution of each to the overall result. It is very important also to make up brigades with workers of high qualifications well supplied with equipment, tools, transportation, and so on. Beside that,

a brigade must constantly see its expenditures for production and clearly represent how economically it is working; that is, it must be independently accountable.

The basic production assets attached to a brigade and the possibility of comparing the production received from them with the expenditures for maintenance should comprise the basis of the independent accountability. As far as possible, the completed production process should be the technological basis of brigade independent accountability. Only such a brigade can work with the greatest output.

Experience in the perfection of the brigade form of labor is available in the industry especially in the production associations Tatneft', Kuybyshevneft', Stavropol'neftegaz, and Bashneft'. Not everywhere, however, is this work well organized and having a practical effect. As yet, only 27.6 percent of the brigades are working in independent accountability, and in the Turkmenneft', Azneft', Uzbekneft' and several other production associations there are absolutely no independently accountable brigades, and only an insignificant part distributes wages according to KTU. In the associations Krasnodarneftegaz, Dagneft', Embaneft', and Kirgizneft' the effectiveness of the introduction of the brigade form is still very low - not a single worker has been released, the technical fitting out of the brigades is too low, and the lists of outfit have not been approved everywhere.

Through production-line brigade succession is being introduced insufficiently intensively in drilling brigades, in derrick construction, and in the exploitation of wells. As yet, 64 percent of the drilling brigades, 51 percent of derrick installing brigades, 31 percent of brigades for well exploitation and 26 percent of the construction brigades have transferred to brigade succession.

Thus, the brigade forms as a method of increasing the efficiency of production and the utilization of labor resources in several production associations are being introduced very slowly with serious deficiencies and therefore are not giving the expected effect. The economic services are obliged to carefully analyze the reasons for such a situation and to substantiate measures for substantially increasing the role of brigades in achieving high final results.

There are many cases when the managers of production, instead of increasing the level of utilization of the labor force on the basis of an optimum organization of labor, strive to create as many as possible new work places and try to increase the limits of the number of personnel. Upon receiving increased limits, they direct them not so much to reinforcing the units for the basic production as for increasing the size of the auxiliary production and the administrative staff.

They disrupt planning discipline, in particular, in Glavtyumenneftegaz, where, with the holding over of the planned population in drilling in 1983, additionally they created a lesser number of new brigades than planned by a factor of three. The situation remained so for 4 months of 1984. Workers of Glavtyumen-

neftegaz frequently note the shortage of labor resources for servicing the stock of wells, but instead of creating permanent and well trained cadres for the basic production, the limits for labor are used up on the maintenance of personnel for auxiliary production.

Labor resources frequently are unsatisfactorily used in auxiliary departments. Thus, at bases UPTO and KO [expansions unknown] because of a low level of organization and a deficient fitting out with mechanisms, labor is extremely unproductive. In the mechanization and automation of production, basic production processes are acutely needed. Only about 30 percent of the oil fields are fitted with reliable telemetering systems, and shop automatic equipment needs reinforcement by personnel and provision with equipment. Automation systems in oil production are being improved slightly and are not bringing in a decisive contribution in lowering labor consumption in the servicing of the stock of wells. The prospects for the further development of automation requires most serious study. The inherent value of the effectiveness of automation and its influence on the productivity of labor, in essence, can be determined only by the economist.

Thus, the problem of the best use of labor resources is multifaceted and very difficult, but it plays a priority role in increasing labor productivity. It is necessary to consider it in a complex with the questions of improving the valuation of labor, improving remuneration systems and incentive pay for stimulating the fulfillment of planned assignments, and increasing the level of the professional skill of worker personnel.

The Ministry of the Petroleum Industry is doing much work in the field of the valuation of labor. The piece-work system of pay has covered 30 percent of workers of the industrial group and practically all time-rate workers are covered by valuation. On the average, the fulfillment of the norm amounts to 116.6 percent and the proportion of technically substantiated norms for time exceeds 83 percent.

Along with this, more detailed analysis reveals serious deficiencies in the practice of the valuation of labor. Thus, labor covered by piece-work pay is much below the average for the industry in the production associations Kuybyshevneft', Permneft', Turkmenneft', and Nizhnevolzhskneft' which is a consequence of the unsatisfactory organization of this work. Deficiencies exist in the field of the use of evaluated assignments for workers with time-rate pay; namely, in the associations Orenburgneft', Belorusneft', and Aktyubinskneft' the coverage of time-rate workers is with a valuation several times below the industry average. And in the associations Gruzneft' and Soyuztermneft' and in Glavtransneft' [The Main Administration for the Transport and Delivery of Oil] this work is not being done.

A careless attitude toward the valuation of labor brings great harm. In the production associations Aktyubinskneft' and Soyuznefteavtomatika [All-Union Industrial Association for the Automation of Oil Production] and in the VPO Soyuzneftegazpererabotka [All-Union Industrial Association for Oil and Gas Refining] and Soyuzneftemashremont [All-Union Industrial Association for the Repair of Oil Producing Machinery] at the enterprises of the Adminis-

tration of Oil Fields and Field Geophysics, time norms being approved are so favorable that workers fulfill them by 135-148 percent on the average and 60-86 percent of the workers overfulfill the norms by more than 20 percent. As a consequence of this, in 1983 at individual enterprises, intrashift idleness increased by almost 30 percent and, at the same time, unjustifiably many overtime hours were used. In the production associations Nizhnevartovskneftegaz and Noyabr'skneftegaz, they exceeded the norm by a factor of 4 to 7.

The favorableness of the norm for drilling footage per bit in drilling leads to this, that the actual expenditure of bits, on the average according to the Ministry of the Petroleum Industry, is 23 percent less than the norm, and in the associations Nizhnevolzhskneft' and Permneft' respectively, is less by 34 and 44 percent. There is insufficient monitoring for the correctness of the valuation of the mechanical speed of drilling. They revise an order for carrying out drilling operations after the completion of drilling a well even if only to include in it earlier unforeseen operations. Such adjustments of orders and favorableness of norms reduce the interest of drilling brigades in increasing the speed of drilling since an accelerated completion of wells is achieved without special stress.

The most important reason for this lies in an ineffective use of labor incentives. It cannot be forgotten that labor incentive must be inseparably connected with its valuation because the latter serves as the measure of the work and the incentive as the evaluation of its amount and quality. Disruption of this principle increases wages without an adequate increase in the productivity of labor. The task of the economic services is to analyze the correctness of the interaction of the systems of labor incentives and labor valuation which are in effect at enterprises because substantial unused potentials are contained in it.

The realization of the task decreed by the December 1983 Plenum of the CPSU Central Committee for a supplementary reduction of the cost of industrial production by 0.5 percent requires the serious attention of the economic services. The measures for the curtailment of the expenditure of material, fuel and energy, labor, and money resources have permitted saving 15.5 million rubles. The plan for profit from industrial activities has not been fulfilled not only because of overexpenditure in cost as a consequence of the nonfulfillment by several associations of the plan for the production of oil, but also because of the nonfulfillment of obligations for supplementary cost reduction by some associations (Tatneft', Kuybyshevneft', and Orenburgneft') which have coped with the planned assignments for production. This can be explained only by poor work by the economic services because potentials for the curtailment of production expenditures are available everywhere to a sufficient degree. At the indicated associations a certain attenuation is adversely affecting the achievement of results and therefore work on the further exposure of potentials for saving has been notably weakened.

Ways of reducing expenditures are varied and rather numerous. Thus, in some regions during the water flooding of formations, the amounts of water injected

exceed what was projected. In so doing, unjustifiably large quantities of energy, fuel and money are spent. Curtailing the volumes of injected water by only one percent would give the industry a saving of more than 10 million rubles.

Experience in the exploitation of wells has shown large possible savings with the gas lifting method of extraction, but this is being given insufficient attention. A large amount of oil is being expended for in-house production needs. In the first quarter of 1984, 10 associations overexpended it. Sometimes it is expended as fuel in drilling or during gas lifting although a number burn gas flames (Aktyubinskneft').

From the report in the central press of May 11th 1984 about the meeting of the Politburo of the CPSU Central Committee, the problem before the national economy of saving petroleum by all possible means and increasing the resources of it is well known. As a consequence, the economists of the industry should be taking a more active role in this work. First of all, it is necessary to more energetically expose and intercept uneconomicalness and extravagance and to provide for progressive planning calculations and well-grounded normalization of the expenditure of material resources. And it is necessary to try for the introduction into the industry of a system of incentives for savings on expenditures which will decisively effect a reduction of costs. In 1983, 17 associations put such a system into practice and, since 1984, 28 associations have transferred to it.

The indicated system is directed at provision of profitable work for the industrial and drilling enterprises inasmuch as the source for the formation of the incentive funds of the associations is the aggregate profit. Such conditions for the fund formation in several associations in 1983 were disrupted. As a consequence of the unsatisfactory work of the drilling enterprises, the incentive funds were not created in full volume which limited the possibility of stimulating the best collectives. An especially incorrect situation built up in the Azneft', Gruzneft', and Embaneft' associations. The basic reason for this is ineffective use of the existing economic mechanism.

Of considerable importance in the work of the economic services is the provision of control over the development and application of intraindustry prices. Overstatements of the profitableness of the production of products for intraindustry use cannot be allowed. For example, substantial overfulfillment of the plan for profit for services rendered by the NPO Soyuzneftepromkhim [All-Union Scientific Production Association for Petroleum Industry Chemicals ] is leading to a reduction of the profitableness of the principal production of the industry.

Of great importance in economic work are initiative and a creative attitude toward exposing unused potentials and also the skill to combine economic principle in work with technological directions for the improvement of production. In this, it is impossible to underrate the importance of socialist competition and the positive role of advanced experience. Leaning on initiative from below and skilfully combining it with organizational and

economic work, an enterprise easily and assuredly can solve the urgent problems of increasing the productivity of labor and lowering production cost.

There are many examples of creative and energetic work in the industry. Thus, G. A. Antonov, the leader of the economic service of the Mirnensk UBR [Administration for Drilling Operations] in the Kuybyshevneft' association is working with great initiative and intelligence. The activity of this service would seem to be limited by the framework of the enterprise; nevertheless the results of the work are of interest to the industry. The economic services of the associations Stavropol'neftegaz (deputy general director A. V. Kuvshinov) and Ukrneft' (deputy general director V. A. Gengalo) are working energetically with a large output of work.

The work of N. Ya. Bulankin, chief economist of the NGDU [Oil and Gas Producing Administration] Arlanneft' of the Bashneft' association, testifies convincingly about the great role of the economist in production. Carefully analyzing the possibilities for the best utilization of the stock of wells, economists of this NGDU were the first to come to the conclusions which subsequently lay at the basis of the widely known Arlansk experience.

Justice should be done to the works of the economic services of the production associations Tatneft' Kuybyshevneft', Permneft', Tomskneft', Belorusneft', Nizhnevolzhskneft', Krasnodarneftegaz, and Ukrneft' for having achieved, as in Bashkiriya, the change-over of almost all brigades for routine repairs into a system of labor incentive for high-quality repair, and increasing the between-repair periods of well exploitation and broadening the zone of servicing. As the result, for these associations in 1982-1983 the number of repairs per year was curtailed by 13,000.

It is very important to draw into the solution of the problem of increasing the productivity of labor and lowering production cost in the principal production, the economists for the auxiliary production, transportation, and construction organizations.

In the successful solution of the problems posed, a large contribution can be made by the scientific and engineering and technical community which are united in the ranks of Scientific and Technical Society of the Oil and Gas Industry imeni I. M. Gubkin. The Central board of the NTO NGP has declared a review for the best statement of the work of its own primary organizations on rendering aid to the enterprises in fulfilling the appeal of the December 1983 Plenum of the CPSU Central Committee about the above-plan increase in the productivity of labor by one percent and the reduction of production cost by 0.5 percent.

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## OIL AND GAS

### FUTURE OF SOVIET GAS SUPPLY SYSTEM CONSIDERED

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 12, Dec 84 pp 84-87

[Article by the chief of a laboratory of the Institute of High Temperatures of the USSR Academy of Sciences, Doctor of Economic Sciences V. Smirnov: "The Development of the Unified Gas Supply Network of the Country" under the heading: "The Fuel and Energy Resources of the Country"]

[Text] The Unified Gas-supply System (YeGS) which has been developed in our country is one of the most powerful and dynamic systems of power engineering. It unites several hundred deposits, scores of underground reservoirs, and thousands of gas consumers (including more than 1500 cities and large population centers). They are connected by main gas pipelines and gas collecting and distributing networks whose extent exceeds 300,000 km. This system is becoming the largest in the world in the production of gas. The levels of production concentration and gas-supply centralization achieved in it are the highest in the world.

In considering the prospects for the future long-range development of the YeGS, a number of problems and questions of planning connected with them can be separated out. Let us dwell on the most important.

#### Increasing the Degree of Integrity of YeGS as a System

The question arises - what will the YeGS be in the future? Will there simply be a quantitative growth of this system or will qualitative changes of it follow simultaneously? Seemingly, it can be affirmed that one of the most important problems in the prospective development of the YeGS is assuring its unity as a system and that the solution of this problem will be one of the directions for increasing the quality of the processes of the functioning and the development of YeGS. This is connected with obtaining the so-called wholeness gain, or the systems gain, (in a number of cases it is called the agglomerative gain, and other things). The fact is, that during an informal unification of elements into a system, the gain from a reduction in expenditures should be brought about which is, properly, a measure of the integrity of the system. So, as applied to the YeGS, the gain from integrity may be determined proceeding as follows. Let us imagine that gas supply in

the country is accomplished by means of a whole complex of isolated working systems for the long-distance transport of gas, each of which includes within itself a corresponding gas industry, one or several main gas pipelines, and a definite circle of gas consumers belonging to them. Let us further unify these isolated long-distance gas-transport systems into YeGS. If the unification is not merely formal but organic, a result of integrity will appear that is measured by a difference of expenditures (for instance, the adjusted expenditures) necessary for the functioning and development of, on the one hand, the isolated working subsystems, and on the other, the whole YeGS. Naturally, in this case the expenses for the whole YeGS should be lower.

What are the main things of which the gain from YeGS integrity is composed? First and foremost, these are the gains which come about during the transmission of the combined maximum loading of the system\*. They come about because of the fact that in the different zones of gas supply in the country, and in the different industrial centers, the maximum gas-supply loadings are at different times in the course of a day, week, or month and so forth.

Therefore, if the system has sufficient power and a variety of connectors between the different subsystems for the long-distance transport of gas, the possibility is created to form an overall schedule for gas consumption, the maximum peak flow of which is lower than the sum of the maximum peaks in gas consumption of the individual subsystems. This gives a payoff in the necessary productive capacities of the facilities for the transport of gas and has a corresponding effect on expenditures.

Is the component of effectiveness brought about by the increased integrity of the system being planned? It seems it can be said - only partially. Indeed, the development of connectors between long-distance gas transport systems is being planned in general. Meanwhile, however, the main thing is missing - the design basis for this planning, because in order to plan the actually necessary connectors for the gas lines it is necessary to know first of all, the expenditures for their development. This is rather simple to evaluate. But, in addition, it is necessary to estimate the gain from them which is that component of the gain from integrity mentioned above. For its determination, it is necessary to have information on the schedules of gas consumption in the very different territorial subsystems and the ways of combining these schedules to get an idea of precisely where do the greatest differences arise between the overall and the local maximum-loading. The institutes of the Ministry of the Gas Industry are faced with much work in this direction.

Another part of the gains from integrity is caused by the fact that to provide for one and the same reliability of gas supply, the cost of standby reserves is less than in the isolated work of individual subsystems or than in the case when internal connections of a system do not provide for cross flows of reserve gas capacity between its subsystems (the case of weak connections and insufficient integrity of the YeGS).

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\* There is a question about a unified, overall schedule of gas consumption for the YeGS.



Is this circumstance being taken into account in planning? In general, yes. Here, however, it seems a more differentiated planning is necessary. The thing is that in this part, the necessary calculating bases have been developed for evaluation of the reliability, the gains, and the expenditures in different variants of the development of YeGS; that is, with a different integrity being planned for it, and it is necessary to include these philosophies in the planning.

The main means of providing for the reliability of the YeGS are, as is known, reserves of capacity, intersystem and intrasystem gas pipeline connectors, underground reservoirs, and a two-fuel economy for gas consumers. They also should become objects of the planning in the design basis for increasing the integrity of YeGS.

The next source of gains from integrity is manipulation of the flows of gas from different deposits. Such a possibility is again provided for by intersystem connectors (this is their third function) and the presence of reserves of capacity (their second function). The redistribution of loadings and the selection of the most advantageous conditions for the combined work of parallel operating subsystems on the overall loading permit reducing expenditures on the in-house needs of the compressor stations and optimizing a number of the other components of the variable expenditures (which depend on the loading of the elements).

This part of the gain is realized by means of optimum planning and control of YeGS in a daily or weekly cross section of time. That function is provided for in the Ministry of the Gas Industry by the appropriate dispatcher service on the basis of an ASU [Automatic System of Control]. This matter is being taken into account in the quarterly plans; that is, by the planning services. Here, however, calculation is wanting of the relationship between the magnitudes of the gains arising in the dispatcher and current-time planning and the long-term plans for the development of YeGS. The fact is that effectiveness of operational or current planning [permits] solving the problem of the increase of that [manipulation] to the extent that the means of increasing the integrity of YeGS - the intersystem connectors, the reserves of capacity and so forth - have been correctly taken into account in the long-term planning.

What has been set forth, it seems to us, shows that in the framework of the planning alone, to solve the problem of increasing the integrity of YeGS is difficult. A general designer of the system is needed. A similar organization is available in USSR Minenergo [Ministry of Power and Electrification] where such a function is carried out by Energoset'proyekt [State Planning and Surveying and Scientific Research Institute of Power Systems and Electrification]. Only in the interaction of planning bodies and Gazset'-proyekt [Gas System Design] is the possibility seen of coordinating the design and planning problems of controlling the integrity of YeGS. Such interaction also is necessary for other problems of the development of YeGS.

## Planning for the Reliability and Flexibility of YeGS

The development of any economic facility takes place under the influence of causative factors and relationships, but one part of them is well defined and the other has elements of indeterminateness (contingency). In this connection, it is understood that with regard to the possibility of indeterminate factors and relationships; that is, taking into account expected anomalies in a system of plans, a number of additional indicators should be established and allowance made for them. Such indicators are called upon to reflect the adaptability of a planned facility to possible changes in the conditions of its development \*.

The adaptability of YeGS can be characterised by the ratio of the expenditures for adaptation (in connection with anticipated changes in the conditions of development) and the initial planned expenditures. The lower this indicator is, the higher the adaptability of the YeGS. In this, the administration of the development of YeGS should take place within a framework for the selection of that variant of the plan which yields the minimum total expenditures - for initial planned expenditures and for adaptation.

A means of controlling the adaptability is increasing the flexibility of the system in its development. Under flexibility is understood the capacity of the YeGS for change of its controlling variables, with fixed expenditures for these changes. There is a question of a change of a different kind - of the degrees of the development of YeGS which characterize its disposition, and the structure of the directions of scientific and technical progress and etc.

Under the reliability of the development of YeGS is understood the expected degree of achieving the planned purpose of the development according to the volumes of deliveries of gas to the national economy and also according to the indicators of the efficiency of its production and transport. It is characterized by the ratio of the expected actual level of gas delivery in one or another prospective year and the planned level of that index.

A feature of the calculation of the reliability of the development is the estimate only of negative deviations which prevent the achievement of the purpose of the development (the possibilities of positive deviations are thus not taken into account here). In plans, increasing the flexibility of YeGS is also a means of controlling the reliability of development.

At the present time, three groups of factors of flexibility have been separated out, with the aid of which, the adaptability and reliability of the development can be controlled.

The first group are the reserves of capacity. It can be emphasized that as distinct from questions of the control of the reliability of operation, there is a question about the reserves not so much in the YeGS itself as in the

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\* See for example, L. A. Melentyev, "Systems Research in Power Engineering", Nauka 1979, and V. A. Smirnov, "Processes of Adaptation in Power Engineering", Nauka, 1983.

interfacing industries of the national economy supplying for the development of the YeGS elements of the fixed and working assets; that is, there is a question about the reserves of capacity of the geological surveying organizations doing surveys for gas (including the reserves of the stocks of it), and the reserves in the piping industry's production of gas pumping equipment in the construction of capacity and so on. Just the availability of these reserves provides flexibility for economic maneuvering, and the problem is to develop them at a certain optimum level (corresponding to a minimum of expenditures based on the expenditures for adaptation).

The second group of factors are structural. It turns out that the flexibility of a variant of the development depends on several of its characteristics which are:

- the relationship of expenditures - constant and variable - to the infrastructure and the facilities, overall (national economy), and industry (in YeGS),

- the degree of diversity of the structures of the systems (the different ranges of resources involved, the diversity of resource capacity for a given kind of resources at different facilities and so on),

- the level of specialization and cooperation,

- the degree of standardization and unification,

- the degree of the connectability of the structure of the members in the system, and a number of others.

The variants of a plan, differing in these factors, have different flexibility and also different adaptability and reliability for development.

The third group of factors are the dynamics of development. These are: the degree of discreteness of the introduction of capacity (larger or smaller by turns), the changes of expenditures for a variant over time (in conditions of uncertainty a strategy of setting aside expenditures and a minimum of ahead of time decisions leads to increased flexibility), and the rate of growth of the system.

Let us present an example of a practical situation when differences are formed in the flexibility of variants of a plan. Let us take the question of the relationship of the production of Tyumen and other sources of gas in the gas balance of the European USSR in perspective. As is known, Tyumen gas is characterized by a large proportion of expenditures on infrastructure and also of constant expenditures. In other regions, the picture of the production of gas is different. Consequently, the relationship being considered influences the flexibility of the variant of the plan.

Or, let us take the structure of the directions of scientific and technical progress in the transport of gas. If it includes many different practices, then there will be a specific diversity of resource consumption (metal consumption according to different routes etc.). Increasing the diversity influences the flexibility of plan decisions inasmuch as possibilities for economic manipulation are increased (for instance, a redistribution of resources). The structure of the directions of scientific and technical progress have an effect on other factors of flexibility.

There are many such differences in the variants of a plan for the development of the YeGS. Taking one or another variant, we consider its flexibility.

Have conditions ripened for the practical use of the concept of adaptation in the working out of plans for the development of the YeGS (yes and not only the YeGS)? It seems that it is yes.

The practice of planning is constantly in conflict with the indefiniteness of much of the future data, and different reliability of plans is realised with different variants of the technical solutions. Categories are used (for instance "favorable stocks of gas" and so on) which take into account indirectly the demand for increased reliability of plans for development. The problem consequently, is to change over from a fragmentary calculation of the properties for adaptation of the YeGS to a fuller control of them for which a methodological basis already is available. An organization of the type of Gazset'proyekt mentioned earlier, could play a substantial role. (The function of organization in the first stage could be taken on by any of the leading institutes of the Ministry of the Gas Industry).

#### Planning for the Effectiveness of Scientific and Technical Progress

For a long time the effectiveness of the basic directions of scientific and technical progress in the production and transport of gas was evaluated within the industry. The effects were calculated of the use of pipes of large diameter and of gas pumping units of increased power, and so on. All calculations came down to the determination of the saving of capital investments, of operating expenses, and also saving of adjusted expenses in the production and transport of gas. But it has been observed that in such an approach to the evaluation of the effectiveness, the practical degree of the influence of the basic directions of scientific and technical progress on the economic indicators of the industry is small. Thus, the comparison of the effects obtained with the levels of capital investment and operational expenses necessary for the development of the industry showed that the degree of influence of scientific and technical progress on the economic indicators of the gas industry is still insufficient. However, if, in the framework of these same approaches, its effectiveness is evaluated in perspective, it seems still lower. Does this reflect the actual situation? It is thought not. It is well known that the gas industry belongs to those industries defining scientific and technical progress in the national economy. In perspective, it occupies a key position in the development of power engineering, however, these circumstances still are not taken into account in the method of calculating the effectiveness of measures of scientific progress. In order to rectify the situation it is necessary to evaluate the gain from scientific and technical progress in a composite of two parts; namely, intraindustry, calculated in the usual method, and interindustry (in the national economy). The interindustry component of the gain is revealed in this, that the use of the measures of scientific and technical progress removes or weakens the limiting restrictions on the development of interfacing industry suppliers and leads to the possibility of supplementary deliveries of gas to the national economy.

Let us consider, as an example, an appraisal of the use of gas pumping units of increased individual capacity. The question is not only that with the increased individual capacity the technical and economic indicators for the transport of gas are improved. Also important is the fact that in using the enlarged units, it is as though productive capacity also is being expanded in gas compressor construction and this should receive a corresponding economic evaluation. It can be in a reflection of this circumstance, that without the corresponding technical measures, it is impossible to provide for the delivery of gas to the national economy or for export because the corresponding limiting restrictions of industry suppliers would be more rigid.

Calculations show that in a long period (both in retrospective and in perspective) a certain objective trend stands out; namely, the proportion of the intraindustry components of the effectiveness of of scientific and technical progress is reduced, but the interindustry component grows.

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## OIL AND GAS

### METHOD OF EVALUATING PETROLEUM RESOURCES PROPOSED

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 12, Dec 84 pp 87-89

[Article by First Deputy Minister of the Ministry of the Petroleum Industry V. Igrevskiy: "An Economic Assessment of Petroleum Deposits" under the heading: "Fuel and Energy Resources of the Country"]

[Text] The question of the economic assessment of petroleum deposits has not only theoretical but great practical importance because it is directly related to the rational consumption of the irreplaceable hydrocarbon resources in nature. The development of a methodical approach to this problem, and also making the assessment itself and the decision based on it for a number of problems relevant to explorations for, survey, design, and development of, the petroleum deposits of the country, have been entrusted to Minneftprom [Ministry of the Petroleum Industry].

As the result of extensive economic investigations based on the Provisional Standard Method for the Economic Assessment of Mineral Deposits, a Provisional Method for the Economic Assessment of Oil and Gas Deposits has been developed and approved by the Ministry of the Petroleum Industry in accordance with an agreement with USSR Goskomtsen [State Committee for Assessments ] and the USSR GKZ [State Commission on Reserves of Mineral Deposits].

Methods for the determination of the complete expenditures for production of the oil producing industry and the indicators for the economic evaluation of petroleum deposits, with the methods of determining and using them, have been included in the industry's method. The integrated indicator of effectiveness (the calculated monetary value) determined over a considered period with regard for the time factor is the basic criterion for the economic assessment of petroleum deposits. The index of the economic assessment of petroleum deposits; that is, the magnitude of the maximum national economic gain from the use of the stocks of them, is determined in the form of the difference between the cost of the final product (oil) and the expenditures for obtaining it.

Everything that is impending is taken into account in the assessment of petroleum deposits and the solution of the problems connected with it; that is, the newly arising capital and current expenditures for surveying, construction, and production of oil. Past expenditures for surveying, con-

struction, and development of a deposit incurred before the beginning of the period of the assessment as, equally, also the stocks of oil which have been drawn off of each deposit under exploitation, are not taken into account. Let us note that investments in drilling wells, the fitting out of the oil field, and also in the creation and development of the productive and unproductive infrastructure are included in the makeup of the impending capital investments. In so doing, expenditures for the replacement of fixed assets which are out of action from physical wear or obsolescence are provided for; therefore, outlays for amortization and renovation of fixed assets are excluded from current expenditures.

The complete expenditures for oil, which determine its value, are, from a national economic viewpoint, the limiting allowable expenditures for the growth (support) of oil production, in the period being considered. For an accurate determination of a standard for the complete expenditures, it is necessary to draw up an optimal plan for the development of the industry in near and long-term perspective; that is, to determine the optimum place of each deposit in the all-union production of oil.

In the method, an approximate way of determining the complete expenditures is offered by means of ranking deposits according to specific expenditures over the period of development.

The level of complete expenditures in the current and the succeeding five-year plans which was adopted in the method is the average weighted value of specific expenditures for the less efficient oil deposits taking part in the 11th Five-Year plan. These are deposits it is necessary to develop in the period of calculation in view of the planned demand for oil including the delivery of it for export. (The project indexes of more than 900 deposits were analyzed). The level of complete expenditures thus obtained permits finding solutions to the industry's problems which approximate the optimum.

This method can be used as an effective instrument for the selection of a rational variant for the economic substantiation of the coefficient of oil recovery and the assessment of deposits.

The rightfulness of these assertions is based, first of all, on the fact that the petroleum deposits, drawn up in order of rank, as a rule already are being developed and cannot produce less oil than the fixed assets created earlier permit recovering. In the second place, the possibility of an increase of the production of oil in the country, to an important degree, will be provided by means of the widespread introduction of the methods of intensification and the consolidation of a network of wells at deposits which are being exploited, especially at deposits with favorable geological production and economic characteristics.

It should especially be emphasized that the definition for the calculation of the complete expenditures is not for the single least efficient deposit, but for a group of deposits because in this case greater reliability and representativeness is achieved in the quality of the indicator and its mobilizing role in the development of methods for increasing the recovery of oil from formations and reducing the load on less efficient deposits.

The complete expenditures are the relation of the total discounted expenditures for the group of deposits being analyzed to the total discounted production of oil from them.

The soundness of the use of the complete expenditures calculated for a group of less efficient deposits, based on their indicators over 20-40 years, in selecting the variant for the study of the deposits ensues, in the first place, from The Methodical Instructions for the Development of Plans for the Economic and Social Development of the USSR as approved by USSR Gosplan. In accordance with them, the optimization of prospective plans for the development of the national economy and individual industries, must be based on the use of average indicators for the subjects over an extended period of their future operation. In the second place, according to those instructions, it is defined that the development of a petroleum deposit according to a rational alternative also will be brought about over an extent of 20-40 or more years which is commensurate with the period for which the complete expenditures for oil are being calculated.

The level of complete expenditures must be refined and reconsidered for every five-year plan depending on the circumstances taking place in the industry. The refined and reconsidered standard then is used for the selection of the optimum variant for the petroleum deposits introduced into development in the corresponding five-year plan.

A criterion for the evaluation of efficiency, constructed on the basis of complete expenditures, is widely used in the petroleum industry.

In the Provisional Method for the Assessment of Oil and Gas Deposits, techniques are offered for the solution of the following primary problems connected with economic assessment:

- the division of oil stocks into reserves and resources with the apportionment in the reserve stock of the part being drawn off,
- the selection of the optimum variant for the development of a petroleum deposit,
- determination of the limit for the development of a deposit and for the exploitation of oil wells,
- the selection of the order for the introduction of deposits into development.

The first problem, basically connected with the preparation of stocks of oil, must be solved in the system of USSR Mingeo [Ministry of Geology] - the remainder in the Ministry of the Petroleum Industry.

The selection of the optimum variant for the development of petroleum deposits, on the successful determination of which largely depends the optimization of the development of the industry, occupies a special place.

In the selection of the optimum variant for development and the solution of other problems connected with economic assessment, it is important to take the factor of time into account correctly. This has been provided for in the Provisional Standard Method for the Economic Assessment of Mineral



Deposits fully answering the demands of the national economy for accelerating the receipt of economic gain. It is unfortunate that in the petroleum industry up to now the judgement persists which belittles the influence of the time factor. Thus, the discounting of expenditures for the variants without discounting the results obtained in this (that is, the production of oil) as widely applied in the determination of the specific expenditures per ton of oil, is one of the deficiencies that should be considered. With such an approach, a tentative decision arises to postpone the beginning of the development of a petroleum deposit, and in a directed introduction of its development into an established period, to begin with the least productive formations in the area.

It is impossible to admit as correct the statement\* that in the oil industry the estimation of the time factor is inaccurate because the qualitative indicators of the development of the industry are deteriorating with the years.

Indeed, accepting the obvious fact of the deterioration of the economic indicators as a consequence of the complication of the rock and geological conditions of the production of oil, it should be kept in mind that technical progress in the national economy cheapens the fixed and working assets used in the oil industry but the accelerated drawing of the oil produced in the oil fields into the national economic turnover renders, in its turn, a favorable influence on the rate of technical progress in the country. Consequently calculation of the time factor in the estimation of all elements (expenditures, and oil production) making up the economic gain is one of the important conditions for the selection of the best variant for the development of deposits.

An important proposition of the Provisional Method for the Economic Assessment of Oil and Gas Deposits is the substantiation of the limit of development of a petroleum deposit (reservoir) and of the exploitation of wells which is used for the solution of the following problems:

- the economic substantiation of the period of development of a deposit (reservoir) and the final coefficient of recovery in planning,

- the determination of the advisability of further exploitation of an individual oil well (its conservation, liquidation, or transformation into an injection or observation well),

- the solution of the question of inactive, standing, low-yield, producing wells,

- the use of an exploratory well situated in a water zone as an injection well,

- the determination of the time for the removal from use of injection, water absorbing, hydrothermal, and iodobromite wells.

The level of expenditure for the production of one ton of oil, above which exploitation should be acknowledged as disadvantageous, is adopted as the economic limit of the development of a deposit (reservoir) or of the exploitation of a producing well.

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\* See: V. I. Luzin, "Estimation of the Time Factor in Substantiating the Rate of Development of Oil Deposits", Neftyanoye Khozyaystvo, No. 5, 1983.

According to the method, the development of a deposit (reservoir) or of the exploitation of a well is being carried on until the actual released expenditures per ton of oil exceed the limiting standard for expenditures.

It is necessary to decide the question about terminating the exploitation of a producing well only after carrying out all measures for increasing the efficiency of its exploitation including a return to a stratum that lies higher up.

The method also may be used in the evaluation of predicted resources of oil and gas and in the determination of the limiting expenditures for the preparation of stocks or of the initial facilities for exploration and surveying and so on.

In so doing, it is necessary to determine the effectiveness not only of the geological survey operations, but also of the production of oil from the surveyed facilities. Hence, the similar problems, in the solution of which USSR Mingeo, Minnefteprom, and Mingazprom have been interested, are involved for the national economy.

In this connection, the experience should be evaluated positively of the collaboration of VNIOENG [All-Union Scientific Research Institute on the Organization, Administration and Economics of the Oil and Gas Industry] (of Minnefteprom) - the chief developer of the Provisional Method for the Economic Assessment of Oil and Gas Deposits - and the VNIGRI [All-Union Scientific Research Institute for Geological Oil Surveying] (of USSR Mingeo) - the chief developer of the planning and prospect evaluation of predicted resources of oil and gas - which, using the indicated method, conducted an assessment of the predicted resources of the Timano-Pechorsk oil-bearing province. This work permitted separating out of the makeup of evaluated predicted oil resources the part of them whose exploitation in the near future is economically unjustified. This experience is being advantageously continued with the purpose of refining the composition of the raw material base of the country.

In conclusion, it should be noted that the proposals considered in the article of the Provisional Method and the fields of its application for the solution of practical problems does not exclude other methods for the selection of the best variants for drawing oil deposits into development, especially methods for the optimization of the disposition of oil production in the combined problem with the disposition of oil refineries and the production of petroleum products.

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## OIL AND GAS

### SUPER-DEEP MURUNTAUSKAYA WELL UNDERWAY

Tashkent PRAVDA VOSTOKA in Russian 17 Oct 84 p 3

[Article by A. Lazarev, PRAVDA VOSTOKA correspondent: "Kizil-Kum's Super-Deep Well"]

[Text] In the Kizil-Kum Desert, near the geologists' town of Muruntau, Uzbekistan's first exploratory well has been put into operation. The first meters of this well were drilled by the team headed by M. Ergashev of the Uzbekneftegasgeologiya [Uzbek Oil and Gas Geological] Association. The pace-setting team lived up to their promises they made to honor the 60th anniversary of the founding of the Uzbek SSR and Uzbekistan's Communist Party: the well was prepared for operation 1 month before the planned deadline. The projected depth is 6,000 meters. Later it is supposed to reach the 7,000-meter mark.

Hero of Socialist Labor G. V. Kasavchenko, chief engineer of the Kizilkumgeologiya Production Association, comments:

"The Muruntau super-deep well represents a qualitatively new step in the exploration of the republic's mineral resources. Before that, no wells in the ore fields were drilled deeper than 1,200 meters. Thus the interest that the super-deep well arouses in both scientific and production organizations is understandable. The data collected during the drilling of this well in the middle of the Kizil-Kum Desert, where various mineral resources are concentrated, will be extremely valuable for both the scientists and the production workers. This set of data will not only make it possible to 'peek' into the warehouses of the desert but will also considerably expand our knowledge of the geology of the underlying strata of the earth's crust and the upper strata of the planetary mantle in this region. And it might also provide the basis for a new approach to some basic questions.

"Expeditions of the Moscow Central Scientific and Research Institute for Exploration of Nonferrous and Noble Metals and of the Central-Asian Scientific and Research Institute of Geology and Mineral Raw Materials will work on the Muruntau super-deep well alongside the production workers.

Analysis results of the first cores are impatiently awaited by the specialists from the Oil Field Geology and Development Institute, the VNII [All-Union Scientific and Research Institute] for Drilling Tools, and other research organizations. The entire effort will be directed by USSR Gosplan, the State Committee for Science and Technology, and the USSR Academy of Sciences.

"This technically complex problem has required a thorough engineering preparation. An extensive program of preliminary operations, such as drilling of exploratory wells, seismic, gravimetric and magnetometric studies, etc., has been performed. The most modern turbo-drill tools are used for drilling in accordance with the latest drilling methods. The drilling methods have been developed on the basis of the experience collected during drilling of the Kola [Peninsula] super-deep well, which now has reached the depth of 12,000 meters.

"The working conditions in the Kizil-Kum Desert dictate a special approach to the organization of work and workers' living conditions. Drilling brigades and brigades that service the well, whose combined services make it an extensive and complex operation, possess significant experience. Projected drilling time was tentatively estimated at 5 to 6 years. Plans are to drill 2,000 meters by the end of the current five-year plan. The workers at the super-deep well have promised to reach this mark 3 months ahead of schedule."

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COAL

UDC 622.01:658.387:658.513.6

COAL MINE OPERATIONS SCHEDULING DISCUSSED

Kiev UGOL' UKRAINY in Russian No 10, Oct 84 pp 13-15

[Article by M. A. Srebnyy, doctor of technical sciences, Coal Workers' Trade Union Central Committee; V. I. Ivanov, candidate of technical sciences, USSR Ministry of the Coal Industry; V. A. Kharchenko, doctor of technical sciences, MGI [Moscow Mining Institute] and Kh. A. Ospanov, candidate of economic sciences, MGI: "Selecting Optimum Coal Mine Operating Schedules"]

[Text] The rate of return from production funds in the coal industry can be improved by more efficiently using the available labor resources. The basis for this improvement is to select the most efficient operating schedules. Since the mines are being reequipped, several factors will improve the use of material, equipment and labor production resources and improve the coal industry's economic efficiency. These factors are: a) a reduction in machine, equipment and material handling downtime, b) an increase in the machine time coefficient and c) an increase in the interchangeability coefficient. At the same time, the creation of better working and rest schedules for the miners is being taken into account by selecting more efficient enterprise operating schedules.

The operating schedules for mines and their main technological links are characterized by the following parameters:

the number of enterprise working days per week (month, year);

the number of shifts per day, including coal production shifts, equipment repair and maintenance shifts and worker protection and safety shifts;

the number of days that a technological link works per week (year or functioning period);

the number of shifts per day that a technological link works doing coal extraction, entry driving and coal and materials handling (i.e., in fulfilling the subdivision's basic function); the volume of equipment repairs and maintenance and the safety measures taken;

the length of shifts, the length of the interval between shifts and the sequencing of shifts and time off.

An analysis has shown that in 600 working faces in UkSSR Minugleprom [Ministry of the Coal Industry] mines and mines in the Eastern Donbass as of 1 June 1983, the most common arrangement was: three six-hour coal production shifts and one six-hour shift for equipment repair and maintenance (80.3 percent). The following arrangements were found at other working faces:

(3x6)M + (1x3)M + (1x3)R; (2x6)M + (1x6)R;  
(2x6)M + (2x6)B; (2x6)M + (1x6)R + (1x4)S + 2B;  
(2x6)M + (2x6)R; (2x6)M + (1x3)M + (1x3)R + (2x3)S  
(3x6)M + (3x2)DB; (1x6)M + (1x6)R + (2x6)B;  
(2x6)M + (1x6)R + (1x6)B  
(2x6)M + (1x3)R + (1x3)M + (1x6)S

M designates mining; R, repair; B, backup shift; S, safety and DB, drilling and blasting.

The large number of different working-face operating schedules is due to the different conditions encountered (UkSSR Minugleprom has coal faces worked by pick hammers, cutters, narrow- and wide-swath cutter-loaders and plows).

The weekly and monthly operating schedules at working faces also vary:

six coal-mining days with one day (Sunday) for equipment repairs or maintenance, the 6M + 1R schedule (15 percent);

seven mining days per week, 7M (18 percent);

one week of six mining days with equipment repair and maintenance on the seventh (6M + 1R), followed by a week with seven mining days 7M (67 percent);

There are also different work schedules at development faces. For instance, the following schedules are used at 10 UkSSR Minugleprom coal production associations:

(3x6)E + (1x6)R, 16 percent; (4x6)E, 44 percent;  
(3x6)E, 18 percent; (3x6)E + (1x6)S, 7 percent;  
(2x6)E + (1x6)R, 4 percent; (2x6)E + (1x6)R + (1x6)S, 4 percent  
(3x6)E + 3R + 3S, 3 percent; (3x6)E + 3 S, 3 percent;  
(1x6)E, 1 percent.

E designates entry driving.

As a rule, the (3x6)E + (1x6)R schedule is used at faces using entry-driving machines, mining machines and rock loaders, taking into account transport scheduling. The (4x6)E and (3x6)E schedules are used at

entries where drilling and blasting and pick hammers are used. At gassy or rock-burst-prone mines, time is set aside for safety operations at the faces. In the Donbass, the weekly (monthly) schedule of entry sections and faces is coordinated with the schedules of the working faces (Table 1).

Table 1.

Donbass	Distribution of entry-driving section work schedules (weekly, monthly) %			
	6E	6E + 1R	7E	I week: 6E + 1R II week: 7E
UkSSSR territory	5	13	2	80
RSFSR territory	7	28	49	7

The schedules for intramine transport generally coincide with the working face and development face schedules. For instance, the most common schedule at UkSSSR Minugleprom mines (95 percent) for working and development faces is (3x6)T + (3T + 3R); the most common schedule at Rostovugol' and Gukovugol' association mines (96 percent) is (3x6)T + (1x6)R. (T designates the transport of coal, rock and materials.) The schedules for process operations and for repair-renewal, degassing, ventilation, and installation sections depend on the schedules of the main sections (mining, development and transport), and have about the same distribution. The weekly (monthly and annual) schedules of coal mines are very different; three or four schedules might be in use within the same association (Table 2).

Table 2.

Donbass	Distribution of coal mines by weekly working schedule, %			
	6M + 1R	7M	I week: 6M + 1R II week: 7	6M
UkSSSR territory	15	18	67	-
RSFSR territory	28	49	16	7

Analysis shows that most mines operate on a continuous work week. This is due to their reduced production capacity and the need to fulfill plan indicators. The greater intensity needed to fulfill the plan is due to the deterioration of mining-geological conditions (shaft depths are not keeping up with mining depths; transport circuits contain many separate links, limiting mine capabilities; the influence of the gas factor is increasing, requiring that a greater volume of work and time be spent on measures to prevent rock bursts and gas blowouts).

It was found that the daily schedule at Donbass mines for plan and nonplan Sundays was the same as for weekdays, i.e., three six-hour coal mining shifts and one six-hour equipment repair and maintenance shift. In

addition, the labor productivity on Sundays is much lower (20-84 percent) when time off is scheduled.

Since most mines operate continuously, the full schedule of equipment repair and maintenance is not carried out (about 50-70 percent of the work is carried out). At working faces, there is a tendency to reduce the maintenance time to 3 hours, resulting in increased downtime due to machine and equipment problems. The machine time coefficient at UkSSR Minugleprom mines dropped to 0.2 due to the failure to meet equipment and preventive maintenance schedules. Modern mines are filled with complex machines and mechanisms. If the production plan is to be fulfilled on a steady basis, then labor resources must be used efficiently. This in turn depends on ensuring machine and equipment reliability and providing reliable processes and process flow. Efficient operation is possible when a certain reliability level is achieved. Therefore, when selecting the most efficient schedule for a mine or an individual section, one must study how the reliability indicator of a machine or a system will be affected by the different schedules.

It was established that there is a great variation in machine and equipment operational readiness. For instance, the operational readiness of a KM-87 mining system is 0.935 for a  $(3 \times 6)M + (1 \times 6)R$  daily schedule, and 0.898 for a  $(4 \times 6)M$  schedule. There are similar variations in machine and equipment operational readiness for entry driving, underground transport and other mine links.

The machine reliability indicators also depend on the amount of repair and maintenance. An analysis of KM-87 system operation with different daily and weekly (monthly) schedules showed that when the daily maintenance time  $t = 360$  minutes, and the operating schedule was  $(3 \times 6)M + (1 \times 6)R$ , the operational readiness was 0.935, while at  $t = 240$  minutes it was 0.906 and at  $t = 180$  minutes it was 0.88. With a weekly working-face schedule of  $7[(3 \times 6)M + 1 \times 6)R]$  and  $t = 360$  minutes, the KM-87 operational readiness was 0.898, which is 4 percent lower than with a schedule of  $6[(3 \times 6)M + (1 \times 6)R]$  and  $t = 180$  minutes. The readiness decreases by 9.5 percent when the schedule is  $7[(3 \times 6)M + (1 \times 6)R]$ . These principles also apply to other schedules.

The goal of selecting an efficient mine schedule is to produce the maximum possible coal production with the minimum labor and production expenditures. One must determine: a) the optimum number of coal mining days per year (month or week), b) the optimum number of shifts and their most efficient duration for technological links, sections and services engaged in both mining and equipment repair and maintenance. One must also take into account labor scheduling and break periods, geological and mining conditions, and also equipment, technological, organizational, economic and social factors.

When selecting an efficient schedule for the mine and the technological links, one must above all provide for increased machine and equipment



reliability. When formulating different possible schedules for the technological links, separate equipment repair and servicing shifts should be included along with the mining shifts, or else preventive maintenance should be scheduled parallel to the mining process. Depending on the geological conditions, time should be provided (part of a shift or an entire shift) for drilling and blasting work and for safety work (daily). When determining the most efficient schedule for a mine, its technological links and sections, organizational factors must be taken into account. These factors characterize the joint functioning of technological links and services inside the mine and determine the degree of efficient, coordinated work with service and consumer enterprises.

The working and time-off schedule is one of the main factors used in determining mine and technological link schedules. When deciding on shift length, one must provide the most efficient ratio between shift length and working week duration. The following factors should be taken into account: a) work intensity for shifts of varying duration; b) labor productivity at different times of the day, particularly at night; and c) the possibility of a reduced number of working days during the week or year in accordance with the established work-week length.

An efficient mine schedule must provide for the fullest use of production equipment at maximum loads over the calendar year. This is achieved by: a) improving machine reliability; b) strict observance of process, equipment use, and safety rules; c) efficient coordination between links within the mine and with other enterprises and d) coordination of mine and labor schedules. Thus, an efficient mine schedule must increase the labor time fund without reducing the average hourly coal production during the course of the year.

The task of selecting an efficient schedule for the mine and technological links is solved in the following manner. First, the work results of all production sections are analyzed, taking into account working time losses, which are classified according to cause. The technological interrelation between the different mine subdivisions can then be determined. Based on the lost working time and equipment downtime, equipment reliability is determined for various schedules. The quantitative relationship between the equipment operational readiness for various schedules is the basis for determining a change in efficiency. One must also determine the effect of the duration and number of equipment maintenance and repair shifts on equipment reliability indicators.

Taking into account the possible changes in equipment reliability, the technological methods and processes used and the best ratio between miner work and rest times, several alternative schedules for mine sections are determined. Also to be taken into account are the established work week, optimum shift length and the most efficient length of time for repairs and safety measures to prevent rock bursts or gas blowouts.

To evaluate the mine schedule, one must consider the activity of the technological links that carry out the main mine function--extracting the planned amount of coal. These links include the working faces, underground transport, hoists and the surface process operations. These links determine the schedules for the other mine links and sections (shops, services).

It is a difficult task to evaluate the different work schedule proposals. Therefore, during schedule development, the operation of the entire mine and its sections is reproduced using the statistical testing method (the Monte Carlo method). By modeling the technological links together, the mine's coal production can be determined. Then, the efficiency of the various schedules can be evaluated and the most efficient schedule selected.

An efficient mine schedule was worked out for the Yuzhnaya Mine of Rostovugol' Association by comparing the indicators for two alternative schedules:  $6[(3 \times 6)M + (1 \times 6)R]$  and  $7[(3 \times 6)M + (1 \times 6)R]$ . The first schedule had the following advantages over the second schedule: 200.7 tons more of average daily working face production, 9.6 percent fewer production personnel, 6.9 tons greater monthly coal production per worker and a 5-percent reduction in the production cost of one ton of coal. Besides the economic advantages, the  $6[(3 \times 6)M + (1 \times 6)R]$  schedule has a social advantage: most of the mine workers have a day off on Sunday, which helps reduce labor turnover and increase worker productivity.

An analysis of mines that constantly fulfill their planned coal production tasks and that operated for 356 days in 1983 showed that the preventive maintenance schedules in these enterprises were strictly followed during the working week. The full volume of repair and maintenance was completed during the repair-preparation shifts. Stable, smoothly functioning mine operation is the result of improved labor and production organization.

Thus, the operating experience of leading mines shows that additional volumes of coal can be produced to meet the economy's demand for fuel. However, these mines can operate on a continuous work-week schedule (more working days per year) only if the preventive maintenance schedules are observed. Continuous production, though, is economically and socially inefficient.

## Conclusions

The selection of a mine schedule must take into account the influence of equipment, technological, organizational, economic and social factors on: a) the increase in coal production and labor productivity, b) the decrease in operating and capital expenditures and c) the improvement in work and time-off schedules.

From an equipment point of view, the efficient schedule must include one repair shift daily for: a) narrow-cut equipment, b) mechanized production

and development systems and c) transport and hoist equipment. In addition, two or three shifts should be scheduled on Sunday for preventive maintenance on machinery and mechanisms.

The efficient schedule for the mine and its technological links should provide: a) identical schedules for production sections that are technologically interrelated; b) concurrent working shifts for the different categories of workers; c) stable brigade and link composition and d) matched output of the technologically interrelated mine links.

The recommended work schedules should be evaluated from a social point of view. Improvements in the work and rest schedules should be made in these directions: a) shift length should be reduced (in coal face operations with mechanized systems, the optimum length is 6 hours); b) mine workers should be given a general day off on Sunday, with two consecutive days off whenever possible and c) weekly time-off schedules should be alternated efficiently.

The most efficient schedules for working faces, development faces, transport, hoists and for the mine as a whole are:

a) for mines with especially difficult working conditions, three six-hour coal production shifts and one six-hour repair-preparation shift; six coal-production days during the week with the seventh day for equipment repair;

b) for mines working seams that have rock-burst, coal-burst and gas-blowout hazards, two coal production shifts, one repair-preparation shift and one safety shift to prevent bursts and blowouts.

The work schedules for the other production sections coincide with the above schedules, except for the surface operations, 6(3x8); the mechanical shop, 6(1x8), and the communications sections, 6(4x6). For underground workers in mines with especially difficult working conditions, the most efficient shift length is six hours.

From the point of view of efficient organization of labor to prevent disruptions in the time schedule, the most efficient organization is a five-link complex brigade.

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COAL

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# MECHANIZATION, NEW TECHNOLOGY TO BOOST UKRAINE COAL OUTPUT

Kiev UGOL' UKRAINY in Russian No 10, Oct 84 p 1

[Article by A. F. Ostapenko, director, Technical Administration of UkSSR Ministry of the Coal Industry, candidate of technical sciences: "The 'Energy Complex' in Action"]

[Text] The coal industry of the UkSSR occupies a leading position in the country's fuel balance. Its advantageous location and the presence of a large number of consumers nearby have challenged the republic's miners to further develop the sector. However, in recent years the fulfillment of plan tasks has become difficult for a number of reasons, mainly due to worsening mining-geological conditions because deeper seams are being worked. Science and technology have been called upon to halt this negative trend.

At the April, 1983 Plenum of the Ukrainian CP Central Committee, Central Committee First Secretary V. V. Shcherbitskiy said: "Results are confirming the correctness and effectiveness of the measures taken both to improve the management of scientific-technical progress and to widely use the program-target method in this area." The republic has developed and is successfully implementing a number of programs, including the special "Energy Complex" scientific-technical program, aimed at improving the fuel-energy complex and improving the use of energy resources to satisfy the growing fuel demands of the economy.

It is a large-scale program, both in purpose and in numbers of participants. Special attention is being given to problems of developing and implementing technology and mechanization in the areas of extraction and preparatory work. These areas include: a) mining thin and very thin seams under difficult mining-geological conditions; b) mining in rocks of average and above-average strength and c) improving miner safety and comfort. The program consists of 125 tasks: 66 tasks involve the development of new equipment and 37 involve the development of advanced technology. During the five-year plan, 44 new machines and mechanisms are to be developed, and 76 innovative technological and technical solutions are to be implemented. The total cost of this work is estimated at 62.8 million rubles, of which about 24 million rubles is earmarked for

scientific research work and over 19 million rubles for capital investments.

When the "Energy Complex" program tasks for improving the mines' equipment base are fulfilled, 65 percent of the extraction work will be done by mechanized systems, while up to 19.9 percent of this work in steeply pitching seams will be done by such systems. The percentage of development work done by mining machines will be increased to 32 percent. The labor intensity will be greatly reduced in mining and development workings, where new equipment is to be introduced.

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## COAL

### COAL ENRICHMENT OPERATIONS AT KORKINSKIY MINE DISCUSSED

Moscow UGOL' in Russian No 10, Oct 84 pp 24-25

[Article by M. D. Kharlamov and R. A. Vaganova, engineers from Chelyabinskugol' Association: "Coal Enrichment at the Korkinskiy Mine"]

[Text] The Korkinskiy Mine is working three primary seams of complex structure which are up to 70 m wide and lie at inclines of 20° to 80° as well as a number of narrow seams. The ash content of the seams ranges from 24-55 percent and the coal content from 8-45 percent. The coal is lignite and it is used for power generation. The deeper the mining operations, the poorer the quality of coal as a result of seam leaching and the increasing thickness of rock layers. In 1983 the ash content of the mined coal was 47.7 percent.

Before shipment to the consumer the coal is enriched at a pneumatic enrichment plant. The enriched coal, that has an ash content of 27.8 percent, is used for municipal and everyday domestic needs and in-situ combustion. Residue particles of less than 13 mm diameter and with 42 percent ash content go to electric power plants and are used for the preparation of powdered fuel. Over its 20 years of operation the plant has processed 107.2 million tons of coal and has produced 21.8 million tons of enriched coal, including 1.1 million tons in excess of planned output.

Mine personnel have accumulated positive experience in coal mining and enriching processes that contributes to maximalizing coal extraction. They set up right at the mine selective sifting units-revolving drum sifters 3 meters across and 5 meters long. This made it possible to avoid large chunks of coal and rock in shipments to the plant and to reduce ash content in the material destined for enrichment by 1.5-2 percent. Similar screens with finer mesh were installed at the plant and incorporated into the preparation process of the raw material before it is fed into the separators. The utilization of revolving screens made it possible to replace the DDZ-3M tooth-roll crushers and made sorting of rock by hand unnecessary. The introduction of these measures freed 70 workers and reduced the ash content of the raw material by another 2.8 percent. Vertical belt elevators for moving the product have been replaced by conveyor belts, which have been operating reliably for more than 20 years. Reconstruction of the scraper conveyors which distribute the machine size material into the separator bins was carried out; this substantially reduced their accident rate. The improved and more efficient SP-12 separators replaced the SPB-100M separators.

In 1980 an experimental model of the new automated SP-12A pneumatic separator was set up and tested. Tests confirmed the advantages of its use in comparison with the [old] SP-12 separator. The utilization of this separator substantially simplifies the coal enrichment process.

Innovators have made a large contribution to the improvement of enrichment technology. In 1983 alone, 29 innovative proposals were introduced at the plant with economic savings of R23,800.

In 1954 a hydro-enrichment installation was constructed at the mine for the extraction of non-standard coal. The raw material for the installation is low quality coal with ash content of up to 70 percent obtained during stripping and also coal extracted from coal/rock piles which remains after seam stripping. The installation operates on a seasonal basis, from April through November. However, the low quality coal is delivered to the receiving area year round, and stored in a specially designated dump by an ESh-6/45 power shovel. Water jets wash the material, and then ZGM-2M suction pumps deliver it to the enrichment installation by slurry line. The enriched coal, with moisture content of up to 30 percent, then goes by conveyor belt to the finished product warehouse equipped with drainage devices. After 7 or 8 days an EKG-4 power shovel loads it for shipment to the consumer. Every year the installation processes up to 1 million m<sup>3</sup> of rock and produces 250-300,000 tons of quality coal with ash content of less than 32 percent. Over its period of operation the installation has produced 12.2 million tons of coal. Its cost in 1983 was 4.5 rubles per ton. Seventy-five workers operate the installation.

In 1974 in response to a proposal by IOTT [not further identified] workers, sharply pitched separators (KNS) replaced washing chutes at the hydro-enrichment installation. At the outset they were tested in the slurry enrichment process, and then starting in 1975 have been used in the enrichment of ordinary unclassified material. The comparative results of KNS and washing chute operations are given in the table.

<u>Type of equipment</u>	<u>Ash content, %</u>		
	<u>Incoming product</u>	<u>Enriched coal</u>	<u>Tailings</u>
Washing chutes	47.1	34.5	76.2
KNS-108 for enrichment of ordinary coal, 0-100 mm diameter	61.6	32.5	78.6
KNS-104 for enrichment of slurry	35.1	20.6	72.8

Since 1979 the enrichment of poor quality coal has been done only on KNS. These separators are noted for their simple construction and control and are adequately efficient in operation. The introduction of the KNS has made it possible to free up 15 units of equipment, to reduce enrichment installation repair and service expenditures, and to raise the efficiency of the enrichment process. Average annual savings as a result of using the KNS is R121,000.

Section manager R. Z. Gurevich, mechanic A. I. Avayev, foreman P. A. Shiryayev and operators N. I. Didun and A. V. Yerokhin contributed much to the introduction of the new high-productivity equipment and the improvement of the process flow line. Mine enrichment equipment and personnel have been working well in 1984 as well. They have overfulfilled their plan for enriched coal by 28,300 tons and for coal for market at 113.9 percent. Over plan production produced an additional R1,664,000 in income.

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COAL

#### AUDIBLE LOCOMOTIVE SIGNAL DEVICE INTRODUCED

Kiev UGOL' UKRAINY in Russian No 10, Oct 84 p 15

[Text] Avtomatgormash has developed the SEZ-1 electrical audible signaling device for battery-powered mine locomotives. Three versions of the device are manufactured by the Krasnyy Metallist Electromechanical Plant in Konotop. The first version is for ARP-14 electric locomotives with a regulated 24-volt DC power supply and a control panel. The signal button and limit resistors are mounted on the panel. The second version is for locomotives with a separate 24-volt battery power supply. The third version is for locomotives with a 110- or 127-volt DC power supply.

The device's welded metal case has a sealed lead-in for an 18-mm cable. A low-frequency amplifier is mounted on the sound emitter. The case has a bolted-on cover.

The device is capable of producing, with a power usage of not more than 3 volt-amperes, a sound level of not less than 10 decibels at a distance of 1 meter along the acoustical axis. The signal frequency can be adjusted within the range 800-1200 hertz.

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COAL

AUTOMATED PLOW CONTROL DEVICE IMPROVED

Kiev UGOL' UKRAINY in Russian No 10, Oct 84 p 15

[Text] Avtomatgormash has modernized the ARUS device, which automates the control of plow units. The device has a number of advantages: a) the limit tension of the working member can be determined; b) integrated circuits are extensively used; c) more precise automatic monitoring of plow position is possible; d) the drive can be reversed in a given section of the face (including at end points); e) the number of leads between the control panel and the face distribution panel has been further reduced; f) a headset is provided for the plow operator etc. The ARUS-lm device allows working face production to increase by 5.3 percent, reduces labor expenditures and improves the safety of plow operation.

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NUCLEAR POWER

CONSTRUCTION DELAYS FRUSTRATE PLANS FOR ODESSA TETS

Kiev RABOCHAYA GAZETA in Russian 11 Oct 84 p 3

[Article by V. Kreshchuk: "Training-Not Swinging--Why Is the Odessa Nuclear TETs Being Built So Slowly"]

[Text] M. V. Feshchenko, the chief engineer of the Odessa nuclear TETs/heat and electric power plant/ construction administration, did not have time to start the morning planning meeting when the foreman of Yuzhteploenergomont/Southern Administration for the Repair of Heat and Power Engineering Equipment/, G. P. Kosovan, came running up to him.

"What should be done? A fire guard worker has again prohibited the issuance of anything from the parts warehouse."

"Evidently some misunderstanding has taken place," Mikhail Vladimirovich sighed, "the planning meeting has to be postponed."

Having returned in half an hour, Feshchenko hurriedly assigned jobs among the sectors and again made for the warehouse. He had become irritated with the fire guard captain A. I. Benera who suddenly lost his agreeableness and was sealing the warehouse for the third week in a row. Mikhail Vladimirovich has to humiliatingly try to get permission to issue one or another type of material. It is costly for the chief engineer to go off somewhere else since Anatoliy Ivanovich places a seal on the warehouse. Feshchenko has to stay on duty here for days on end in view of the entire construction project. This time Benera carries on comprehensible discussions with him.

"I warned you even last year--until you equip the warehouse with fire protection devices, the delivery of materials here is prohibited. There are now already four and a half million rubles worth of various valuable things in it and there has not been and there is not now an internal firefighting water supply, there is no lightning protection, and there are not even any basic devices for putting out a fire. The second gates do not open and the aisles are clogged. A roof was carelessly made. Water is leaking directly on the carbide."

"A welder is coming today," Feshchenko began, "he will cut the beam and the gates will open. And a water supply line is already being laid."

"You must hurry or else winter will be here already," Benera says, showing by his entire appearance that the time for believing in promises has ended and that now he will only believe actions.

Understanding that comrade Feshchenko is not an assistant to us today, we leave him at the "battle post" and we set out for the concrete-mixing shop. I want to note right away that the Odessa nuclear TETs builders are in more favorable circumstances than their colleagues from many other construction projects. They have been allotted a fairly long preparation period. The first cubic meter of concrete was laid in the foundation of one of the industrial base enterprises on 15 May 1981. During the time which has passed since that date, a sea moorage has been built at Belgorod-Dnestrovskiy and a river one is being constructed on the Dnepr, a motor vehicle road network has been laid, and Tepلودar--the settlement of builders and operational personnel, continues to grow and improve. However, the builders are far from always intelligently managing the time assigned for preparation. And this happens not only because of their inefficiency.

We found A. V. Plaksiyenko, installer brigade leader of a sector of the Yuzh-teploenergomontazh trust in a thoughtful mood near a bench on which designs were spread out.

"I have been working at construction projects for almost three decades now," the brigade leader says, "and I have yet to see such lack of coordination as there is here. We recently covered the concrete-unit walls with tiles and we had to re-lay them three times until all the seams were at the necessary level. Time and again we are met with lack of coordination in planning the concrete-mixing shop which the Odessa branch of the institute Orgenergostroy/All-Union Institute for the Planning of Electric Power Projects/ gave us."

Anatoliy Viktorovich's brigade is now installing equipment in the milk of lime preparation room. They had to depart from the plan many times here so that the installed equipment would operate.

"We have changed the system for pumping the plasticizer," A. V. Plaksiyenko says, "but we had to take down the already installed equipment to do this. We have made cofferdams not specified by the plan in order to feed hot water at a volume which will be required during the winter."

Then the brigade leader showed us the receiving department where a huge bin for lime had been installed. Its lower opening was square and the crusher's reception chamber, located below, was shaped like a stretched-out rectangle.

"It's beyond me how to connect them," the experienced builder spread his hands. "We have many times requested that either a chief engineer or a staff member from the institute be at the construction project on a regular basis. Only then will it be possible to quickly clear up all the unfinished work of the designers and jointly make the right decisions."

"In August I had to draw up 30 documents for alterations and additional work," the foreman G. P. Kosovan joins in the conversation.

The plan called for starting the finishing work on the concrete-mixing shop equipment at the beginning of October. Three months were allotted for it. Meanwhile, things came to a complete halt at the fill warehouse which will supply the sand and crushed stone, because ground water was flooding the tunnel under the pile and it was impossible to install transporters and other equipment there. This occurred because the Promstroy/All-Union Construction Trust/-1 sector workers of the nuclear TETs construction administration, the general contractor, poorly concreted the tunnels and then the Kiev administration Yuzhenergodorstroyizolyatsiya/Southern Power Project and Road-Building Construction Insulation Administration/ workers, in their turn, did a poor-quality job on the exterior insulation.

The indifference of Vladimir Fedorovich Dubenskiy, who heads the management of the nuclear TETs under construction, to the situation which has been created is surprising. He already has 58 specialists under him who have full power to carry out competent technical control over construction. To establish order at the construction project, management must be more concerned about coordinating the activities of construction organizations and when forming plans to erect individual projects for the year and to consider the long-term technical priority for putting them into operation. It would be worthwhile for the general customer, the UkSSR Ministry of Power and Electrification, to more attentively analyze the plan before approval so that more extraordinary occurrences like the construction of the railroad branch from the station of Vygodna to the industrial base do not take place. The trust Odess-transstroy/Odessa Construction and Installation Trust of Transportation Construction/ has until next year to turn it over for operation. But, as the saying goes, it is urgently needed right away.

Arkadiy Savchuk, a representative of the "zeroer" brigade, arrived at our industrial base from Teplodar. The brigade had not been provided with concrete for installing drilled cast in-place piles under the foundation of a residential building. And Savchuk left without it. There was not enough concrete which is produced by two plants. All of the transportation was directed at moving sand, crushed stone and cement from the station and there was no time to transport bricks from Odessa which were needed to cover the cable in the ditches. Many of these difficulties could have been avoided if there had been a railroad branch.

Do not call the decision of the customer to build a warehouse at Vygodna station well thought-out. It is a considerable distance from here to the construction site and additional freight transshipments and added expenditures are unavoidable. This is especially so as there are not enough warehouses at the industrial base itself. Therefore, now a large part of expensive equipment has already been stacked in an open area. It is difficult to visualize why such a storage method was adopted, if one may say so.

The nuclear plant's trade union staff, headed by I. N. Nazarenko, chairman of the obkom/oblast party committee/ of the power station and electrical engineering industry worker trade union, can and must do much to improve the coordination of the activities of construction organizations and suppliers. The relieved deputy chief of the trade union staff, V. I. Stadnichenko, is constantly at the construction project. It would seem that things should be

at a boiling point and they are barely getting warm. The industrial base does not even have a display on which the work results of the subunits can be effectively highlighted, and which would show to whom one should be compared and whose attitude toward work must be reviewed. Staff members are limiting their activities mainly to those things which are put down in the bulletins hanging in the reception room of the SU/construction administration/ chief--the work results of the collectives during the month.

It is already high time for the staff to concern itself with developing socialist competition on the "workers' relay race" principle. The experience of organizing it will be especially necessary in the year when the construction of the main projects will begin.

"We are hoping that the 'workers' relay race' will help to improve the rhythm of deliveries," says the chief of the production and technical division of the general contractor administration A. N. Tatanenko. The Kiev Experimental Design Plant of USSR Minenergo/Ministry of Power and Electrification/ is at present hampering the shipment of 200 tons of parts. The Izobilnenskiy ZhBK/reinforced concrete structures/ Plant, located in Stavropol Kray, has been 1,700 cubic meters of reinforced concrete structures in arrears. Half of them are extremely necessary for the construction of a building in which they plan to hold a house-warming party for 76 families of builders at the end of the year.

It is necessary to strengthen trade union influence over the collectives of the trust Elektroyuzhmontazh/Southern Trust for Planning and Performing Electrical Installation Work/, the Kiev administration Yuzhenergosantekhmontazh/Southern Administration for Power and Sanitary Engineering Installation/, the administration Donbassenergostroymekhanizatsiya/Don Basin Administration for Power System Construction Mechanization/, the construction sectors of which are too sparse and poorly provided with equipment here. The first ones are hampering the installation of equipment required for this year's start-up projects. The second ones are late in laying communications and they have put back the deadline six months for turning over the vegetable store for operation. The third ones have "forgotten" to finish the vertical lay-out of the road from Teplodar to the line at Belyayevka, without paying attention to the fact that more than 1,000 people are standing in line at the construction project for housing, and they have put off for almost a year the preparation of the land for the construction of mobile homes.

It turns out that many persons have perceived the period of preparation for the main work as a period of swinging. And it is easy for some to get away with it. However, it cannot continue this way for long. It is time to give the authoritative word both to the representatives of the general customer and the subcontractor ministries.

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## NUCLEAR POWER

### BRIEFS

THERMONUCLEAR REACTOR CONSTRUCTION CONFERENCE--(LentASS)--Participants at the All-Union Conference on the Research and Development of Construction Materials for Thermonuclear Fusion Reactors considered thermonuclear machine models-- prototypes of the next century's inexhaustible power sources. This was the third representative meeting of specialists in this area convened, by tradition, in Leningrad by the USSR Academy of Sciences and the USSR State Committee on the Use of Nuclear Power. Representatives of the leading scientific centers of our country as well as specialists from Bulgaria, Hungary, the GDR, Czechoslovakia, and a group of Euratom staff members from the united scientific research center in Ispra (Italy) participated in its work. "The active work on creating 'TOKAMAK' and other types of thermonuclear reactors which is being conducted both in our country and abroad has as its own ultimate aim the development of new kinds of energy," said Professor L. I. Ivanov, chairman of the coordinating council of the USSR Academy of Sciences, commenting on the results of the conference. "This has to do first of all with the development of fundamentally new types of materials for equipment which has to operate under the severest conditions of extremely high (in tens of millions of degrees) temperatures, a high vacuum, and unprecedented radiation loads. The reports presented at the conference by the Soviet participants showed that we have come real close to creating such materials. This will speed up the job of constructing the first demonstration reactors and, after them, experimental thermonuclear power plants by the end of the century. The conference's foreign guests gave high marks to the achievements of Soviet scientists and specialists and to the prospects for international cooperation in solving one of the main scientific and technical problems of the present. The conference summed up the results and outlined future directions in the area of creating construction materials for thermonuclear fusion reactors. [Text] [Leningrad LENINGRADSKAYA PRAVDA in Russian 23 Nov 84 p 3] 8524

ODESSA ATETS CONSTRUCTION PROGRESS--Odessa Oblast--Engineering preparation for the construction of the first large-scale industrial nuclear TETs/heat and electric power plant/ not far from Odessa is coming to an end. It will be constructed on the base of two power blocks of one million kilowatts each with water-cooled reactors. The multi-year operation of the small Bilibinskaya AES/nuclear electric power plant/ as well as the use of the heat of the Beloyarskaya, Kurskaya, Smolenskaya, Novovoronezhskaya, and other nuclear electric power plants for heating power worker settlements have also demonstrated the progressiveness of this trend in developing domestic power

engineering. Up to one thousand gigacalories of heat per hour are required for the heating and other everyday needs of a small city with a population of 300,000 people. The boiler houses must burn 400 tons of mazut for this. The Odessa ATETs/nuclear heat and electric power plant/ will permit doing away with thousands of small boiler houses and improving the air basin and it will become an additional powerful source of electric energy. [By L. Kaybysheva/ [Text/ [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 7 Oct 84 p 2/ 8524

KOLSKAYA AES REACHES CAPACITY--The Kolskaya nuclear power plant, the northernmost in the world, has reached planned capacity. The fourth, by count, and last power block has been placed under an industrial load here. [Text/ [Moscow EKONOMICHESKAYA GAZETA in Russian No 43, Oct 84 p 3/ 8524

ZAPOROZHYYE AES REACTOR START-UP--Energodar (Zaporozhye Oblast) 10/Nov/--The physical start-up of the one-million kilowatt first power block reactor took place yesterday at the Zaporozhye AES/nuclear electric power plant/. Intensive work by all construction project participants preceded this event. Tests of the reactor installation during the hot break-in period have confirmed the high quality of their work which has provided the reliable operation of the technological systems and equipment. Now the instruments have recorded the first breath of the reactor. The day is not far off when the electric power of the Zaporozhye nuclear plant will enter the service of the national economy of the country. [PRAVDA stringer I. Sergeyeva/ [Text/ [Moscow PRAVDA in Russian 11 Nov 84 p 1/ 8524

IGNALINSKAYA AES POWER CAPACITIES--Vilnius 9 /Nov/--A significant event has occurred at the Ignalinskaya nuclear electric power plant. The first power block, which was put into service at the beginning of the year, reached a capacity of 1.2 million kilowatts. This is a record in Soviet nuclear power engineering practice. The efforts of the builders and operational personnel have now been directed to going to a planned capacity of 1.5 million kilowatts next year and to starting up the second reactor in the first year of the new five-year plan. In ten months of operation the AES/nuclear electric power plant/ has already generated 3.5 billion kilowatt hours of electric power including 128 million above-the-plan hours. [PRAVDA correspondent D. Shnyukas/ [Text/ [Moscow PRAVDA in Russian 10 Nov 84 p 1/ 8524

KALININ AES ASSEMBLY--Leningrad--The Elektrosila Association has completed assembly of the stator of a 1-million-kw turbogenerator destined for the Kalinin AES. One in two of all the turbogenerators at the country's power stations is manufactured by Elektrosila, and the association will this year be increasing its output by over 20 percent, with 1-million-kw generators being built for the Zaporozhye, Balakovo, and Ignalina atomic power stations. The chief task in 1985 will be to complete the manufacture of a unique type of cryogenically-cooled [as heard] turbogenerator with a capacity of 300 mw. Ahead lies the tricky task of building the rotor for this cryoturbogenerator. [Summary] [Moscow Television Service in Russian 1620 GMT 26 Jan 85 LD]



ATOMIC POWER PLANT DESIGNED--Soviet specialists have concluded work on designing a new type of atomic power plant. These are to be built in Minsk and in Odessa. They will provide the cities with electricity and serve as powerful suppliers of heat. Each unit of such a plant is capable of ensuring heat for residential areas housing 350,000 persons, said Professor Nikolay (Sinyev), a leading researcher in the field. Such heat and power plants will make it possible to save vast quantities of natural fuel and to promote environmental protection, he told Radio Moscow. There has been no accident at Soviet atomic plants in the 30 years of their exploitation. [Text] [Moscow World Service in English 0800 GMT 22 Jan 85 LD]

CSO: 1812/122

## NON-NUCLEAR POWER

### BURSHTYNSKAYA GRES CONVERTS TO GAS

Kiev PRAVDA UKRAINY in Russian 13 Sep 84 p 1

[Article by M. Fedik, PRAVDA UKRAINY correspondent, from the Ivano-Frankovskaya oblast, "Gas Comes On Shift", under the rubric, "Reconstruction"]

[Text] The Burshtynskaya GRES [State Regional Electric Power Station] is now experiencing its second youth. This is connected to the thermal power station's conversion to gas. A few days ago natural gas was fed into three of the station's primary units.

The Ukrainian word "burshtyn" is "amber" in Russian, or sunstone. According to legends amber, polished and washed by the sea, was carried onto the sand by the waves. There was no sea here. There was a river with the offensive name Clay Lime. With the appearance of the GRES the Burshtyn sea, too, was splashed up. And today on its shore, the power plant and the power production workers' settlement are also located.

The settlement is drowning in luxurious vegetation, with which the Carpathian region is lavishly endowed, and even the GRES plant yard is alive with red roses, which glow like electric flames. And, towering above all this beauty there are black columns of smoke, going up high into the sky. While they are still towering there, their days are numbered.

Initially, I saw a photograph of this man on the station's Board of Honor. During our meeting, Stepan Aksent'yevich Stepas' said, half-jokingly, "I am now a deputy, squared: a deputy secretary of the party committee, and deputy chief engineer of the station."

With figures in hand, Stepan Aksent'yevich concretely defined verbatim each point of the advantage of operating the station on gas. Here are a few of his calculations. At the Burshtyn GRES, they will attain a satisfactory proportionate outlay of standard fuel among the same-type power blocks. Using coal, the station uses up 349 grams of standard fuel (at a plan indicator of 355 grams), to produce one kilowatt-hour of power. But with a conversion to gas, less than that, 344 grams, will be consumed. These five grams which are saved for each kilowatt hour will effect a savings of 70 thousand tons of standard fuel per year, or 120 thousand tons of the coal which the GRES now obtains from the Lvov-Volyn Basin. On gas, the cost of a ton of standard fuel is

reduced by 5.75 rubles in comparison with coal. Economists have calculated that not a month will pass before the station pays back the expenses incurred by its gasification.

The advantages which deal with preservation of the environment are no less impressive. Twenty thousand tons of coal are burned in GRES furnaces every day, and a third of this comprises products of that burning: ash and soot. Even with the effective improved filters which are available to the station nowadays, every day a great amount of these products fly out of the smoke-stack and are dispersed all around.

It is clear, that working conditions will also be improved with a conversion of the GRES to gas--along with the coal, dust, soot and dirt will also disappear from the workplace. But the responsibility of each person involved in the conversion to gas will increase.

"We have organized courses for the workers and engineering-technical personnel and other categories of workers," recounts S. A. Stepas'. "The theoretical studies have been completed, and most of the operational personnel have already passed the exams in gas technology inspections, which were given to our workers. The corresponding instructions and plans have been prepared."

According to the upcoming plan, which has been adopted by the USSR Ministry of Power and Electrification, in the next few months all remaining power plant furnaces will be converted to gas operation. After that is done, it will be time to lay gas lines to the settlement.

12659  
CSO: 1822/91

## NON-NUCLEAR POWER

### UNIQUE LITHUANIAN GAES DESCRIBED

Moscow GUDOK in Russian 25 Oct 84 p 4

[Article by L. Lyubimov, in Kayshyadoris, "GAES on a Hill"]

[Text] Our vehicle has come to a stop on the hillside. From here, there's a good view of the entire panorama of the huge construction site of this one-of-a-kind power plant. Below is the Neman River-Kaunas water reservoir overflow. Closer to us, at the foot of the hill, is a deep earthen basin. Over there, on the very bottom where the tractors and trucks are moving around, they are laying the foundation for the future power plant building. Its substructure is being set 36 meters lower than the water reservoir level. And even though the soil here is sandy-gravelly, no water is visible in the foundation area.

"That's the work of the water-lowering pumps," says A. Makulis, construction-site supervisor and deputy chief of the Litenergostroy [Lithuanian Power Plant Construction] Administration, pointing to the small structures located around the perimeter of the foundation area. "Otherwise we'd have an island in the foundation area. The turbines will be positioned lower than the natural water level, and they will also be playing the role of water supply pumps".

Up above, and higher than the place where we are standing, they are at work erecting a circular embankment, the 26-meter-thick walls of the future hillside water reservoir. It is 6.5 kilometers long, and will hold 47 million cubic meters of water.

A water reservoir on a hill?--the reader wonders. Yes! Pumped storage power plants are special structures. Until recently they were constructed solely on an experimental basis. Similar power stations stored up electricity for future use. During peak hours, when industry requires maximum power, the Kayshyadorskaya GAES will be switched into the network.

The low elevation of the bottom of the water reservoir is 100 meters higher than the Kaunas sea level. The water, falling from this elevation through eight pipelines and passing through the turbines will produce 2.4 million kw of electric power during eight hours of operation. For a thermal electric power station to do this would require 3.790 tons of standard fuel, or one-and a half block trains of mazut. The Kayshyadorskaya GAES will be the most

electric power plant of its type not only in this country, but also in Europe.

The pipelines will be a complicated engineering installation. The construction workers call the site where they are to be laid a "proving ground". Each pipeline is 250 meters long, and its ferroconcrete walls are 40 centimeters thick. The weight of only one running meter of this pipe is 40 tons. The inside diameter of the pipeline is 7.5 meters, a unique tunnel in which two buses can easily pass each other.

Thousands of tons of cement, metal and sand are required in the construction of all the tremendous structures of the future power plant. In this year alone, 220 thousand cubic meters are slated to be poured.

According to the plan, the new hydroelectric power plant should be put into operation by the end of this five-year plan period. It will effect a great savings in fuel for the power system of the northwest region. There is only a little time left before the start-up of the power plant. And efforts at all sections are being carried out intensely.

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CSO: 1822/91

NON-NUCLEAR POWER

BRIEFS

SHULBINSK TURBINE FOUNDATIONS POURED--KaSSR (TASS)--Construction of the Shulbinskaya GES, which is the third in a series of GES's on the Irtysh River, has entered a new stage. They have begun laying the concrete foundations for the turbine units. No less than 200 thousand cubic meters of concrete are scheduled to be poured this year. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 38, Sep 84 p 3] 12659

NOVOANGRENSKAYA GRES STARTUP READY--Start-up and adjustment operations have begun ahead of schedule on the first power block of the Novoangrenskaya GRES, which is being built in Uzbekistan. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 38, Sep 84 p 3] 12659

SAYANO-SHUSHENSKAYA GES INCREASES CAPACITY--Sayanogorsk, Krasnoyarsk Kray (TASS)--At the Sayano-Shushenskaya GES, the eighth electric power generating unit was put under commercial load today. The hydraulic engineers put it into operation a month before schedule, and a week faster than the previous, seventh unit. [Text] [Moscow PRAVDA in Russian, 11 Oct 84 p 2] 12659

TUYAMUYUNSKAYA GES INCREASES CAPACITY--The fifth power block at the Tuyamuyunskaya GES, being built on the Amu Darya, (Khorezm Oblast), has been put under commercial load. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 41, Oct 84 p 2] 12659

STAVROPOL POWER LINES TESTED--The 500-kilovolt power transmission line from the Stavropolskaya GRES to the Ingurskaya GES has been turned over for pre-operational testing. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 41, Oct 84 p 2] 12659

SAYANO-SHUSHENSKAYA GES RAISES CAPACITY--The eighth electric power generating unit of the Sayano-Shushenskaya GES was put under commercial load. The hydraulic engineers put it into operation a month ahead of schedule. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 43, Oct 84 p 3] 12659

UZBEKISTAN POWER CONFERENCE HELD--(UzTag)--Problems entailed in enhancing the operational stability and reliability of the USSR's power systems are being discussed at the All-Union Scientific and Technical Conference, which commenced 28 August in Tashkent. Leading specialists of the ministries and planning and scientific research institutes, energy system administration production

controllers and guests from Bulgaria, Hungary and Czechoslovakia are participating in the conference. Reports have been submitted for consideration on the problems of setting up a structure for power production capacities and on growth principles for the electric power networks of the country's Unified Power Production System, which will insure the reliable operation and improved effectiveness for the primary electric power-producing equipment and theories. Conferees are being familiarized with the stages involved in organizing both the structure of the Uzbek power system, and the prospects for its further development. [Text] [Tashkent PRAVDA VOSTOKA in Russian 30 Aug 84 p 1] 12659

ASTRAKHAN POWER LINES GROWING--Volgograd (TASS)--Specialists of the Yugovostok-elektroset'sstroy [Southeastern Electric Power Network Construction] Trust have already installed over 300 metallic and ferroconcrete supports on the right-of-way for the Volgograd-Astrakhan 500-volt LEP [power transmission line]. This new electric span will improve the power supply to Astrakhan's enterprises. The power transmission line is proceeding southward along the right bank of the Volga. Working on the open steppe is difficult; nevertheless, not only are the installers proceeding according to schedule, but they are trying to reduce the time spent on each operation, having taken on increased obligations in honor of the 40th anniversary of victory in the Great Patriotic War. Their powerful modern equipment is being used productively. Over one thousand supports in all will be installed in this electric bridge. Each tower is 30 meters high. Improvements in their design make it possible to install three towers per kilometer instead of four, which was previously the case. [Text] [Moscow PRAVDA in Russian 24 Sep 84 p 1] 12659

TOKTOGULSKAYA GES ENGINEERS LAUDED--Frunze--Operators of the Toktogulskaya GES have completed their year's assignment ahead of schedule. This station put over 5.5 billion kw/hour into the unified Central Asian system. These results are due to the skill of the power engineers, who were able to extend the inter-service period for turbines, and who brought the last of three power stations, the Kurpsayskaya, up to planned capacity ahead of schedule. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 43, Oct 84 p 4] 12659

MOLDAVSKAYA GRES PRAISED--Kishinev--During the 20 years which have passed since the start-up of its first power block, the Moldavskaya Gres has produced 200 billion kw/hour of electric power. Right now, 12 power blocks are in operation here, with a total capacity of 2.5 million kw. The Moldavskaya GRES is one of the most economical. From the very beginning, it has saved up to 100 grams of conventional fuel for every kw/hour produced. This is the only reason the station has been able to save over 280 thousand tons of coal and mazut. After the country's first PGU-250 steam-gas turbine was installed and put into operation here, even greater savings were effected. The powerful river of power-production from this TES feeds electric power not only to the cities and villages of Moldavia, but to neighboring republics as well. [By A. Romanov, personal IZVESTIYA correspondent] [Text] [Moscow IZVESTIYA in Russian 27 Oct 84 p 2] 12659

CHEBOKSARSKAYA GES INCREASES CAPACITY--The 13th unit of the Cheboksarskaya GES has been put into operation. Now, the overall capacity of this station, which

is the conclusive step in the Volga power production series, has exceeded a million kw. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 44, Oct 84 p 2] 12659

RYAZANSKAYA GRES GAS CONVERSION--The builders, installers and operational personnel of the Ryazanskaya GRES have fulfilled their strenuous pre-October obligations. They have successfully completed conversion of the station's second stage over to an economical form of fuel--natural gas. A saving of two million tons of mazut, which previously had been burned in one year in the boiler furnaces, has been effected. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 44, Oct 84 p 2] 12659

GRES STEAM GENERATOR PREPARATIONS--Not long ago, an important event occurred here. Installation was begun on the unique bearing beams for a structure from which a steam generator, weighing more than 20 thousand tons, and which is 100 meters high, will be suspended. Parallel with the installation of the GRES vessel, leading brigades of the Vostokenergmontazh [Eastern Power Plan Installation] Trust are carrying out consolidated installation of 50 blocks of the station's first boiler. Eight of the blocks, with an overall weight of almost 4.5 thousand tons are now ready to take their places in the GRES's main vessel. N. Spirin's brigade has distinguished itself in the installation of the boiler's assemblies. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 44, Oct 84 p 2] 12659

TUYAMUYUNSKAYA GES INCREASES CAPACITY--Druzhba, UzSSR--The sixth and last power block of the Tuyamuyunskaya GES has been put under commercial load. The first hydroelectric station on the Amudarya River to have 150 thousand kw capacity was made fully operational in a remarkably short time. Its power feeds the industrial centers of the Khorezm Oasis in Uzbekistan and a number of Turkmen regions. The water accumulated in the basin of the Tuyamuyunskiy water reservoir is used to irrigate hundreds of thousands of hectares of arid land. [By R. Tell'] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 11 Nov 84 p 1] 12659

KAVKAZELEKTROSET'S TROY LINES CROSS MOUNTAINS--Tbilisi--A 500 thousand volt power transmission line linking up the Ingurskaya GES with the Stavropolskaya GRES has been put into operation. Construction workers of the Kavkazelektroset's troy [Caucasus Electric Power Network Construction] Trust, in spite of the challenging geological conditions--the right-of-way passes across inaccessible cliffs, ravines and rivers--were, by using progressive methods of organizing labor, able to reduce the cost and the construction time. This was helped, in particular, through the use of new methods of installing power line supports in high mountain conditions. [By G. Namtalashvili, SOTSIALISTICHESKAYA INDUSTRIYA personal correspondent] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian, 12 Oct 84 p 2] 12659

MOSCOW HEAT SUPPLY INCREASED--Installation work on the 4th power block, with a 250 thousand kw capacity, is proceeding at full speed and right on schedule at the Moscow TETs-26. Ever since it began operation, the inhabitants of



Biryulev, Chertanov, Yasenev and Orekhov-Borisov have been recipients of a great source of heat and electric power. The 250-thousand kw capacity paired turbines, which are produced by the Uralskiy Turbomotor Plant imeni Voroshilov, are the largest in the world. Each of them is capable, for example, of supplying heat and light to a city with a population of 300 thousand. This is the second such unit at TETs-26. The first was put into operation in March of this year, three months ahead of schedule. For the first time in this country, this type of unit was installed twice as fast as standard deadlines. Efforts are also proceeding fruitfully at this time on the 4th power block, which will supply current to the Moscow power ring, and heat to the inhabitants of the capitol's southern areas. [Excerpt] [Moscow MOSKOVSKAYA PRAVDA in Russian 17 Oct 84 p 1] 12659

TUYAMUYUNSKAYA GES OPERATING FULLY--(Uztag)--The sixth and last power block of the Tuyamuyunskaya GES was put into operation with a commercial load on 25 October. Now the total capacity of the first hydroelectric station on the Amudarya River has reached 150 thousand kw. The dam has been placed on its full projected load. The level of the water which has been accumulating since the first days of autumn in the integrated water power development's artificial reservoirs, has risen by 20 meters. In all, 5.3 billion cubic meters of vivifying water will be collected here. Even today, the Tuyamuyun reservoir provides a guaranteed increase of 245 thousand hectares of irrigated land. [By Yu. Ibragimov, UzTAG correspondent] [Excerpt] [Tashkent PRAVDA VOSTOKA in Russian 27 Oct 84 p 1] 12659

SAYANO-SHUSHENSKAYA GES JOINS SYSTEM--Sayanogorsk--At the Sayano-Shushenskaya GES, the 8th hydroelectric unit, with a capacity of 640 thousand kw, was connected to Siberia's Unified Power System. New methods were used here to install the hydroelectric unit assemblies. Sections with elastic coverings were used for the first time on such large machines. This innovation, which was proposed by specialists, improves the operational reliability of this unique equipment. The height of the dam has reached 203 meters. [By M. Malakhov] [Excerpt] [Moscow IZVESTIYA in Russian 18 Oct 84 p 1] 12659

TUYAMUYUNSKAYA GES INCREASES CAPACITY--Druzhba, Khorezm Oblast (UzTAG)--The capacity of the Tuyamuyunskaya GES, which is being constructed on the Amudarya River, has been increased by 25 thousand more kilowatts. Since the day the first unit started up, the station has produced about 600 million kw/hour. With full development of the projected capacity--150 thousand kw--the Tuyamuyunskaya GES improves the power supply to the lower areas of the Amudarya, and will bring new plants and factories, and pumping stations and irrigation systems into operation, and will supply light to new well-organized residential tracts. [By Yu. Ibragimov, UzTAG correspondent] [Excerpt] [Tashkent PRAVDA VOSTOKA in Russian 29 Sep 84 p 2] 12659

PECHORSKAYA GRES INCREASES CAPACITIES--Pechora, Komi ASSR--The command "Start!" rang out, and the turbo unit shaft went into motion. The instrument needles of the Pechorskaya GRES control panel fluttered. The third power block, with a capacity of 210 thousand kilowatts, had been put into operation. Timano-Pechora, which conceals nine-tenths of the region's fuel resources in its

depths, is called the Pearl of the European North. The power produced by the unit which has just been put into operation will give life to the new mines, and the oil and gas industries. [By Yu. Zhigaylov, PRAVDA correspondent]  
[Text] [Moscow PRAVDA in Russian 4 Oct 84 p 1] 12659

KHABAROVSK-KOMSOMOLSK-NA-AMUR LEP NEARS COMPLETION--Khabarovsk--The unprecedented flood waters of the taiga's rivers, through which the supports of the Khabarovsk-Komsomolsk-na-Amur LEP-500 [500-kilovolt power transmission line] are placed, did not disrupt the rushing work pace on the 365-km right-of-way. Construction on this project is entering its final phase: installation of the lines has begun. A great volume of work here is done by pilots delivering people, mechanisms and various loads to the cut-throughs in the taiga. Helicopters are also used to roll out the transmission lines. Wide use is made at this construction site of advanced labor methods and technical innovations. The power-bridge which is under construction here is a continuation of the Zeyskaya GES-Khabarovsk LEP-500, which is in operation. This section is slated to be put into operation at the end of the year. [Text] [Moscow SEL'SKAYA ZHIZN' in Russian 22 Sep 84 p 1] 12659

SAYANO-SHUSHENSKAYA GES INCREASES CAPACITIES--Sayanogorsk--At the Sayano-Shushenskaya GES, the 8th hydroelectric unit, with a capacity of 640 thousand kw, was put under commercial load 2.5 months ahead of schedule. This station has already produced about 40 billion kw/hour into the country's power production system. Preparations to install the 9th and 10th turbines are proceeding. More than 8 million cubic meters of concrete have been poured for the foundations of the GES structures, and 72 thousand tons of metallic structures have been installed. [Text] [Moscow SEL'SKAYA ZHIZN' in Russian 17 Oct 84 p 4] 12659

UST-ILIMSK GES RECORD OUTPUT--The Ust-Ilimsk GES has produced 1.5 billion kWh of electricity since the beginning of the year. This is a record output for this period. Every 24 hours the third hydroelectric power station of the Angara cascade produces over 70 million kWh of electricity for the country's unified energy system. The high level at the reservoir will ensure a maximum load for the GES sets through to the spring. [Text] [Moscow Domestic Service in Russian 1600 GMT 24 Jan 85 LD]

CSO: 1822/147

## PIPELINE CONSTRUCTION

### POLISH-USSR PIPELINE COLLABORATION DISCUSSED

Moscow SOVETSKAYA BELORUSSIYA in Russian 6 Nov 84 p 2

[Article by N. Pavlovskiy, SOVETSKAYA BELORUSSIYA correspondent: "The Friendship Mainline"]

[Text] Many of the cars on the Kobrin-Minsk highway sport "Energopol'-6" emblems. Road signs with the same title in Polish lead in the direction of the village of Petki. Around the outskirts of the village, the little railroad cars which are used as housing are lined up in neat rows. Beyond them, the rumble of heavy-duty dumptrucks and powerful self-propelled cranes is audible from morning to night. This is where they are building the industrial base for the construction of the new Kobrin-Brest-Warsaw gas pipeline, which is one of the largest facilities expressing international cooperation within the SEV [Council for Mutual Economic Aid] framework. When this pipeline is put into operation, this fraternal country will receive the first billion cubic meters of gas as soon as 1986.

Several Polish construction organizations, Transbud, Geoprojekt and Elektromontazh, for example, are participating in the construction of this pipeline. But the Energopol'-6 Firm will be directly engaged in construction of the right-of-way. Many specialists from the Polish People's Republic accumulated a wealth of experience in laying oil and gas mainlines in our country. Their work was highly esteemed by their Soviet colleagues in Velikiye Luki, Uzhgorod, Novopolotsk and so on.

And here at this new construction site, the workers from this fraternal country continue to strengthen this traditional friendship. They set up the business connections with a collective from the Kobrin-based Zapadtransgaz [possibly Western Gas Transport] PO [Production Association] Line Production Administration for Main Gas Pipelines.

"Fraternal mutual aid speeds up the work rates," says Construction Supervisor Bogdan Slonechny, "and we work enthusiastically. Each of us Poles understands that the shock work on this friendship gas main that we are building is a unique answer to the Reagan administration and its western allies who have attempted to blackmail Poland by depriving us of the opportunity to purchase needed raw materials on the socialist market. The Soviet Union lent our country support in a difficult time, taking it upon itself to increase the annual

gas export by about five billion cubic meters. The gas main we are at work on will provide a large part of these deliveries.

The rhythm of the construction of these new buildings becomes more intense. Soon the first pipes will be laid in the ground. They are already being joined into extended lengths. Here is where the experience of the Soviet welding-assembly brigades, who built the Siberia-Western Europe main line, comes into play. Proving-ground Director Zdislav Banashkevich is now readying the truck-tractor pipe-haulers to deliver the finished pipeline sections to their installation sites.

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CSO: 1822/88

## PIPELINE CONSTRUCTION

### URENGOY-TSENTR-II PIPELINE PROGRESS REPORT

Moscow EKONOMICHESKAYA GAZETA in Russian No 46, Nov 84 p 4

[Article by A. Panin: "On the Gas Pipeline Routes in October", on the occasion of the 67th anniversary of the October Revolution]

[Text] Minneftegazstroy [Ministry of Construction of Petroleum and Gas Industry Enterprises] organizations and enterprises who are constructing the Uren-goy-Tsentr II main are greeting the 67th anniversary of the Great October Socialist Revolution with excellent labor achievements. As of 1 November, over 2000 km of the gas pipeline had been welded into the line, about 1,900 km had been insulated and over 700 km are in operation and are undergoing tests. In the month of October over 150 km of right-of-way had been constructed.

Leading collectives of Glavtruboprovodstroy [possibly Main Pipeline Construction Administration], Glavvostoktruboprovodstroy [possibly Main Eastern Pipeline Construction Administration], Glavsibtruboprovodstroy [possibly Main Siberian Pipeline Construction Administration] have put individual sections into operation well ahead of schedule.

The Mosgazprovodstroy [possibly Moscow Gas Pipeline Construction Trust], the Shchekingazstroy [possibly Shchekino Gas Industry Construction Trust] and the Bryansktruboprovodstroy [possibly Bryansk Pipeline Construction Trust] have completed insulating and laying work on their sections, are conducting tests, and are completing their official registration for acceptance certificates with the state commissions, as is the Ryazantruboprovodstroy Trust [possibly Ryazan Pipeline Construction Trust]. The Severtruboprovodstroy [possibly Northern Pipeline Construction] Trust constructed more than 300-km of the pipeline in one section at high rates during October. Part of this was put into operation in October.

According to the results of the socialist competition for October, the production lines headed by I. Shaykhutdinov, of the Tatnefteprovodstroy [Tatar Oil Pipeline Construction] Trust, and Yu. Semenyuk, of the Kuybyshevtruboprovodstroy [Kuybyshev Pipeline Construction] Trust, were recognized as best.

A total of about 40 production lines are at work building the main line. The autumn season of impassable roads effects the work of many of the production lines, especially those working in Western Siberia and the Urals. However,

in spite of the difficulties, the daily work rate for October amounted to 5 to 10 km.

As practice shows, the speed of construction for gas pipelines, with the onset of freezing weather in November and December, increases 2-2.5-fold, compared to October. The construction workers are preparing for shock work.

Collectives of Minneftegazstroy and of other organizations have concentrated their efforts on the start-up gas-pumping stations of the Urengoy-Tsentr I gas pipeline. In ten months, Minneftegazstroy trusts have put eight compressor stations into operation. They should put 11 more into operation in November and December.

Collectives of the Kazymgazpromstroy [Kazym Gas Industry Construction] Trust, (administered by V. Lysyuk), the Severgazstroy [Northern Gas Construction] Komsomol Youth Trust (administered by M. Karant), and the Nadymgazpromstroy [Nadym Gas Industry Construction] Trust (headed by V. Zavizion), set examples for well-coordinated, efficient work during construction of the Bobrovskaya, Yagelnaya and Khasyreyskaya compressor stations. At the same time, efforts need to be accelerated on the other start-up stations of this gas pipeline.

As is always the case during the period prior to start-up, the operations of the contracted construction organizations and the customer--Mingazprom [Ministry of the Gas Industry]--need to be efficiently coordinated and unified. Concerning this matter, good results have been achieved during this period: complete deliveries of equipment are going better, and start-up and adjustment operations are being carried out more industriously. The builders and the customer are obliged to strengthen and develop these positive tendencies.

Organizations of USSR Minpromstroy [Ministry of Industrial Construction], USSR Minstroy [Ministry of Construction], USSR Mintyazhstroy [Ministry of Construction of Heavy Industry Enterprises] and USSR Minenergo [Ministry of Power and Electrification] are successfully at work on the construction of compressor stations.

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## PIPELINE CONSTRUCTION

### URENGOY-TSENTR-I PIPELINE PROGRESS REPORT

Moscow EKONOMICHESKAYA GAZETA in Russian No 41, Oct 84 p 5

[Article by V. Voznyak: "On the Gas Pipeline Routes"]

[Text] By the beginning of October, 1,620 km out of 3,032 km of the Urengoy-Tsentr II gas pipeline had been built. In spite of the inclement weather in September, the length of the finished part of the main was increased by 140 km that month. The eight comprehensive production lines, which are at work in the European section of the country have already completed construction on the sections assigned to them.

Glavsibtruboprovodstroy [possibly Main Siberian Pipeline Construction Association] organizations were able to carry out construction operations only in a few relatively dry locations, and are preparing for widespread expansion of efforts on the right-of-way with the onset of freezing weather.

About 500 km of the main were tested during September. As we know, the pipeline proceeds along a single corridor with the operating lines. Therefore it is possible to connect the finished sections up to the existing gas transport system. As a result, the fuel supply will be increased during the upcoming autumn-winter season.

Workers of the Soyuzpodvodtruboprovodstroy [possibly All-Union Underwater Pipeline Construction] Association are trying to complete the underwater crossings ahead of the deadlines, so as not to delay getting the finished pipeline sections into operation. In September they completed driving the tunnel across the huge Siberian river, the Kamyz, and the Don and the Tsna flood-plain, too, were crossed and preparatory work was done on the Volga, Nadya and Kama river crossings.

Construction continues on the compressor stations for the main gas pipelines. Here, major attention is given over to putting the new pumping-over capacities on the operating Urengoy-Tsentr-I gas pipeline into operation. In September, the Pravokhettinskaya, Oktyabr'skaya, Komsomol'skaya and Lyalinskaya subdivisions of Minneftegazstroy [Ministry of Construction of Petroleum and Gas Industry Enterprises] worked well, and insured the completion of their plan assignments on the compressor stations. Organizations of USSR Mintyazhstroy [Ministry of Construction of Heavy Industry Enterprises] completed their work

on the Yeletskaya Compressor Station, and organizations of USSR Minstroy [Ministry of Construction] finished theirs on the Pochinkovskaya station. USSR Minmontazhspetsstroy [Ministry of Installation and Special Construction Work] subdivisions did a great amount of work.

Construction has begun on the next main gas pipeline system, the Yamburg-Yel-ets, which is 3,162 km long.

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## PIPELINE CONSTRUCTION

### BRIEFS

**GAS ARRIVES IN TARAKLIYA--(ATEM)**--A flare has been ignited in Tarakliya, with the arrival of Western Siberian natural gas in the regional center. It came by way of the pipeline which was laid off of the USSR-Bulgaria mainline, which crosses the southern part of the republic. A network of gas distribution lines was laid in the village along Karl Marx, Dimitrov and Sovetskaya streets in advance of the arrival of the gas. They will begin connecting up residences to them before long. Next in line for conversion to natural gas is one of the boiler houses which supplies heat to homes, children's preschools and the Palace of Culture. And the largest of its consumers will be the boiler house now under construction, to which a creamery, a distillery, vehicle fleets and other enterprises will be connected. During the 11th Five-Year Plan period, a systematic effort is being made in the republic to provide natural gas to the population centers of the Dnestr River region and the Budzhak Steppe. The export pipeline was the basis for their gasification. Chadyr-Lunga, Vulkaneshty, Suvorovo, Slobodzeya, Kaushany and a number of villages have been connected to this pipeline. Laying of two more 50-km branch lines to Bessarabka and Kagul will be completed by year's end. [Text] [Kishinev SOVETSKAYA MOLDAVIYA in Russian 13 Oct 84 p 2] 12659

**GURYEY GASIFIED--Guryev (KazTAG)**--Workers' apartments on the Sovkhoz imeni Amangel'dy are being heated with gas from the Central Asia-Tsentr-I main gas pipeline. The gas was delivered along a 20-km branch line. The sovkhos boiler house, which heats a kindergarten, a school, a club and over half of the local economy's housing facilities, was refitted for natural gas operation. An integrated program for the gasification of the auls and villages of the northern Caspian region is continuing. By the end of next year, the 180-km Inder-Guryev branch line will be laid from the country's major gas main, and will supply the oblast center and the Makhambetskiy and Inder regions with inexpensive fuel. [Text] [Alma-Ata KAZAKHSTANSKAYA PRAVDA in Russian 7 Oct 84 p 1] 12659

**SVERDLOVSK OBLAST INCREASES CAPACITIES--Sverdlovsk**--A collective of the Turbomotor Plant imeni K. Ye. Voroshilov, in accordance with its obligations, has installed thirty units for the gas-pumping stations located on the Ural arm of the Urengoy-Uzhgorod-Western Europe, and Urengoy-Tsentr gas mains. A powerful GTN-16 turbine, which was just unloaded, and which is designed to increase the capacity of the Pelymskaya station, is the first Urengoy stage within the Sverdlovsk Oblast. It will produce tens of millions of cubic meters of gas

daily. It surpasses foreign models in its reliability and many technical parameters. [By V. Biryukov] [Text] [Moscow IZVESTIYA in Russian 10 Oct 84 p 1] 12659

INNOVATIVE VOLGA CROSSING SUCCESSFUL--Zvenigovo, Mariyskaya ASSR--A reserve tunnel [dyuker] on the Urengoy-Tsentral pipeline has been successfully laid across the Volga. Steel pipes, joined together into a single length of over two km, was laid on the river bottom right next to an operating main line in the shortest possible time. [Text] [Moscow SEL'SKAYA ZHIZN' in Russian 18 Oct 84 p 1] 12659

AGRYZSKAYA PUMPING STATION OPERATING--The flow of transportable Siberian gas into the Urengoy-Uzhgorod pipeline has increased considerably. On the right-of-way, the second unit of the Agryzskaya pumping station in Udmurtiya has been brought up to planned capacity ahead of schedule. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 41, Oct 84 p 2] 12659

PIPELINE CLEANING METHOD DISCOVERED--Kharkov, (TASS)--Kharkov scientists and engineers have suggested an original method for cleaning large-diameter pipelines which will increase their carrying capacity considerably. An operational check of this innovation was made with success today on the Ukrainian section of the "Soyuz" International Gas Pipeline, which was laid from the Urals to the western border of the country. It is also scheduled for use on the Urengoy-Pomary-Uzhgorod transcontinental gas pipeline before the end of the year. A similar cleaning of major main pipelines will effect a yearly saving of millions of rubles. [Text] [Baku VYSHKA in Russian 14 Oct 84 p 1] 12659

UNDERGROUND GAS STOREHOUSE READIED--Nadym, Yamalo-Nenetskiy Autonomous Okrug--In the Tyumen North, a new underground gas storehouse, i.e., the Yamburg Field, is being readied for operation. Valuable hydrocarbon raw materials will be extracted from here in Yelets for the first time during the upcoming five-year plan period. Construction workers of the Severtruboprovodstroy [Northern Pipeline Construction] Trust have already set about laying a heavy-duty fuel artery from Nadym to Yamburg. They are constructing the first of three shift settlements. [By V. Lisin, PRAVDA correspondent] [Text] [Moscow PRAVDA in Russian 21 Aug 84 p 1] 12659

CENTRAL ASIAN PIPELINES CONNECTED --Having solved the well-known school problem of the communicating vessels, one can, as it turns out, receive not only a good grade, but can also obtain a large economic effect. This has been proven by Soyuzuzbekgazprom [All-Union Uzbekistan Gas Industry] Association specialists, on whose suggestion two mainline gas "rivers" have been joined by an 80-km pipeline. Natural gas from the Bukhara gas region is delivered along one of the pipeline-rivers to Tashkent and even farther, to Frunze and Alma-Ata. In the last few years, in connection with connecting the major commercial enterprises in the Fergana valley and the Golodnaya Steppe to it, this "river" grew "shallow" on the approach to Tashkent, and gas transport along the remaining section fell off. On the other hand, in the other, Dzhar-kak-Bukhara-Samarkand-Tashkent main gas pipeline, the fuel pressure was excessive. The Pakhtakor-Yangier pipeline, which the Sredazneftegazstroy [Central

Asian Oil and Gas Construction] Trust laid in a very short time; has joined these two main lines. And now the fuel supply to the capitol of the republic and to neighboring Central Asian republics has increased by several million cubic meters per day. [By A. Skorobogatov, UzTAG correspondent] [Text] [Tashkent PRAVDA VOSTOKA in Russian 15 Aug 84 p 3] 12659

CONSTRUCTION ADMINISTRATION EFFORTS PRAISED--Sheki--It was not so long ago that SU-8 [Construction Administration] became independent, and was called to lay gas pipelines in the cities and villages of the Sheki-Zakatal'skiy area. The collective has accomplished a considerable volume of work this year, and has managed to cope with the plan. In just the last two months, gasification has been completed in a number of sections of Sheki, a fruit-processing plant in the village of Dzhafarabad, and the central farm of the "Sheki" grape-growing sovkhos, where gas was made available to more than 170 families. This is twice the plan quota. In addition, more than six km of main pipeline were laid in the village of Chichekdakhna. Initial operations are continuing here with vigor. The obligations which they took on for this year are being successfully taken care of by the welders R. Azizov and R. Nukhov and fitter O. Ismailov who all exceed the daily quota by 50-60 percent. The construction workers have taken the obligation to complete the gasification of the villages of Chichekdakhna and Dzhairli before the end of the year, and to begin work in Beyukdakhna. [By N. Ismaylov] [Text] [Baku VYSHKA in Russian 29 Sep 84 p 2] 12659

GAS-OIL OFFICIALS DISCIPLINED--"Catch Up to the Clink of the Glasses"--This was the title given to correspondence from F. Nazyrov, which was printed 29 June 1984. As A. Kumylganov, deputy director of the Main Administration for Transporting and Delivering Oil, a commission from the Main Administration made a check of the activity of the Technological Transport and Special Equipment Department of the Southern Administration for Main Oil Pipelines. For violations which were permitted in the financial-economic and production work of the department, A. Kashirskiy, director of the Southern Administration for Main Oil Pipelines had the amount of his bonus reduced by 50 percent. For tolerating violations in the operation, Deputy Director of the Department of Technological Transport and Special Equipment L. Lovchikov has been discharged according to Paragraph I, page 248 of the KaSSR KZot [Labor Laws Code]. The newspapers which had been published were examined at a joint session of the local organization of the Southern Administration of Main Oil Pipelines and the Presidium of the Trade Union Line Committee, with the assistance of the secretary of the departmental party organizations. The department collective's measures, which were directed at strengthening labor discipline and order, were approved and confirmed. [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 16 Sep 84 p 2] 12659

UNDERWATER TUNNEL CONSTRUCTION PROGRESSES--Zvenigovo--The last length of pipe has been welded onto the three-kilometer tunnel of the Kholmogory-Klin main oil pipeline. The steel tunnel is on the point of joining the two banks of the Volga. The main pipeline crossing is being built by the SUPTR-4 [not further identified] of the Vostoktruboprovodstroy [Eastern Pipeline Construction] Trust, from Kazan. Right at this time, the other integrated brigade, V. Cher-

nyavskiy's, in the city of Zvenigovo, in the neighboring Mariyskaya ASSR, is dragging a reserve tunnel of over two kilometers' length across the Volga as part of the Urengoy-Tsentr I gas pipeline. "And we are laying this tunnel ahead of schedule, and exceeding our own high obligations," explains V. Pili-penko, director of SUPTR-4 [possibly Construction Administration for Pipe-line Crossing Operations], as we talk together in Zvenigovo. "We cannot do otherwise. The rush of the production lines who are laying the new mains forces us to hurry. And in the winter, when the freezes seize the swamps, the right-of-way workers move even faster. That is why we, at the same time we are laying the reserve tunnel for the Urengoy-Tsentr I gas pipeline,

are completing development of the next trench, for the underwater crossing for the Urengoy-Tsentr II line. We will lay that one in the first half of November. At the same time, we are developing the trench for another Yamburg-Yelets gas pipeline. We intend on completing it before the end of the ship-ping season, but we will drag the pipe beneath the ice. Thus, the oil tunnel has practically been laid, the next gas tunnel is being laid through the Vol-ga, and the trenches for the two are already being prepared. By the way, the reserve line for the Urengoy-Tsentr I pipeline is a new word from the const-ruktion workers who build underwater pipelines in the Volga-Kama basin. For the first time pipe, with a diameter of 1,420 mm is being laid, and not the 1,220-mm pipe they used previously. [By U. Bogdalov, SOTSIALISTICHESKAYA IND-USTRIYA personal correspondent] [Excerpt] [Moscow SOTSIALISTICHESKAYA INDUS-TRIYA in Russian 16 Oct 84 p 1] 12659

URENGOY-TSENTR-I PIPELINE TESTS--Morshansk--On the Volzhskiy-Lipetskiy section of the Urengoy-Tsentr II gas pipeline, they are completing tests of a main, the overall length of which is 326 km. It was laid by large mechanized units of Glavtruboprovodstroy [Main Pipeline Construction Administration]. They finished up six months ahead of the planned deadlines. The tempo of construc-tion which was achieved on the Urengoy-Uzhgorod export gas pipeline, has been exceeded here by 1.5-fold. The industry's leading production units, led by Hero of Socialist Labor V. Belyayeva, and by the experienced production organ-izers A. Buyankin and A. Krakhmalev, frequently for days overcame the two-km construction limit, which was, for many of the subdivisions, sacred. This is the result of constant improvement in the collective methods of labor, which are based on pay according to finished construction work. Ahead of the gas workers is the new Yamburg-Yelets main, which is to be built in addition to the five-year plan. [By V. Levin] [Text] [Moscow IZVESTIYA in Russian 5 Oct 84 p 1] 12659

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GENERAL

CURRENT CEMA POWER PROJECTS VIEWED

Moscow FOREIGN TRADE in English No 11, Nov 84 pp 9-15

[Article by Alexandr Kachanov, first deputy chairman of the USSR State Committee for Foreign Economic Relations]

[Text]

Economic cooperation with the socialist countries based on equality, mutual benefit and fraternal cooperation aimed at strengthening the material base of the socialist community as a whole and each country's industrial potential individually was and is in the centre of attention of the CPSU Central Committee and the Soviet Government. K. U. Chernenko, General Secretary of the CPSU Central Committee, in his speech at the February (1984) Plenary Meeting of the CPSU Central Committee said: "By all roundly developing and deepening consolidation and cooperation with the socialist community countries in all spheres including, of course, such an important one as the economy, we thus greatly contribute to the cause of peace, progress and security of peoples."

The fraternal countries, consistently realizing the strategy of development and deepening of the socialist economic integration elaborated by the communist and workers' parties, strive to jointly solve the most pressing large-scale problems which are of great significance for the development of their economies.

The change of the structure of our countries' fuel-energy balance towards increasing the portion of progressive highly effective energy sources is one of these important problems.

The Long-term programme of cooperation in the field of energy, fuel and raw material specified the development of atomic power engineering which already in the next decade should become the basic

source for augmenting power capacities in the CMEA member-countries and in the European part of the Soviet Union as the main direction for accomplishing this task.

The Soviet Union began cooperating with the CMEA member-countries in atomic power engineering in the mid-1950s when the first agreements on rendering technical assistance in constructing experimental-industrial atomic power stations in the GDR and Czechoslovakia were signed. The main purpose for constructing these atomic power stations was to improve the stations' technological systems and safety, accumulate experience of their operation and train national specialists.

In the late 1960s-early 1970s bilateral intergovernmental agreements were signed with Bulgaria, Hungary, the GDR, Czechoslovakia on the rendering of technical assistance in constructing and operating atomic power stations with 440 MW power blocks and VVER-440 reactor installations in these countries of which the Soviet Union had ample experience. The first large industrial atomic power stations built in the socialist countries were: in the GDR—the Nord atomic power station (total rated capacity 3.52 million kW), in Bulgaria—the Kozloduy atomic power station (1.76 million kW). In 1974-1975 these stations' first power blocks were put into use. Later, construction of atomic power stations started in Czechoslovakia and Hungary.

The Soviet Union helped the socialist countries to gain experience in designing, building and operating atomic power stations. Simultaneously large work was undertaken to create specialized capacities in the European socialist countries manufacturing, to Soviet technical documents, sophisticated technological equipment for atomic power stations. The main design work in that period was fulfilled by Soviet organizations. The Soviet Union also supplied necessary technological equipment and helped instruct the socialist countries' specialists in the specifics of operating the atomic power stations being built.

The designs of atomic power stations constructed in foreign countries with the Soviet Union's assistance were based on those with water-moderated reactors in which usual water is used as the heat-transfer agent and moderator of neutrons. They are

considered very reliable, safe and economic in all kinds of climates.

At present 24 power blocks with VVER-440 reactors are successfully operating at atomic power stations in Bulgaria, Hungary, the GDR, Czechoslovakia and the USSR.

The General Agreement on long-term development of the CMEA member-countries' integrated electric power engineering systems for the period up to 1990 signed in 1977 and the Programme of the maximum development of the CMEA member-countries' atomic power engineering including cooperation and specialization in this sphere adopted in 1977 at the 31st meeting of the Session of the Council for Mutual Economic Assistance constitute the foundation of the Soviet Union's long-term cooperation with other CMEA member-countries in this field.

The above General Agreement envisages the construction of a great number of atomic power stations in the European CMEA member-countries based on cooperation and the USSR's scientific and technical assistance.

The USSR helps design, build and operate atomic power stations under bilateral agreements. Our country fulfils functions of a general designer of atomic power stations being equipped with Soviet atomic reactors.

The great expansion of atomic power engineering assures, on the one hand, the constant improvement of atomic power stations and, on the other, demands maximum standardization, and unification of design solutions and broad use of standard equipment.

According to forecasts, the share of electric energy generated at atomic power stations in separate European socialist countries should reach 20 to 30 per cent by 1990. It is self-evident that successful realization of the planned programmes for wide construction of atomic power stations in the CMEA member-countries is possible only providing the wide-scale production of standardized technological equipment is organized and the proper base of atomic power engineering created.

Even from the mid-1970s the Soviet Union, under bilateral understandings, began assisting the European socialist countries in creating their relevant specialized capacities manufacturing equip-

ment for atomic power stations. Within a short period of time they had to fulfil a task which presented problems for the socialist countries' machine-building industry of mastering the manufacture of high class nuclear equipment. High requirements put on the quality of this equipment caused radical restructuring of the existing "know-how," application of new materials, introduction of the latest quality control methods and supplying the production shops with new equipment. Only joint efforts could quickly accomplish these large-scale industrial tasks. In the course of their practical realization the corresponding organizations in the USSR and other CMEA member-countries had to develop new and more effective methods and forms of mutual relations since previous experience in solving such large-scale technical and organizational questions on the basis of cooperation was not available.

A characteristic feature of Soviet organizations' cooperation with their partners in the socialist countries is its comprehensiveness. This, particularly, is seen from the fact that already at the beginning of the cooperation close contacts were established in setting up the necessary scientific and technical base, in making the needed special metals, in mastering the latest welding methods, in acquiring the sophisticated technology for manufacturing atomic power station equipment. Using this cooperation to the full the CMEA member-countries drew up the corresponding standard and technical documents. The Soviet Union transferred the necessary design, technological and other documents. Soviet scientists, highly skilled specialists gave instruction and consultations at the socialist countries' enterprises and the Soviet Union's leading factories.

At the same time in the socialist countries new enterprises were built and existing ones modernized. All this tremendous joint work assured the fulfilment of the set goals within a short time. By 1980 the European socialist countries' industries had mastered production and since then have been delivering VVER-440 complete reactor installations, steam generators, pressurizers, main circulating pipelines, turbo-generator installations, biological shielding equipment, special water treatment equipment, heat exchangers, circular travelling cranes, a great amount of special accessories, etc.



Altogether the manufacture of nearly 20 named items of technological equipment was mastered with which the Paks atomic power station (Hungary), the Nord atomic power station (the GDR), the Bogunice and Dukovany atomic power stations (Czechoslovakia) and a number of Soviet atomic power stations were fitted out.

The accumulated experience and positive practical results of specialization in production of technological equipment for atomic power stations as well as the creation of the corresponding industrial base made it possible to transfer the multilateral cooperation to a qualitatively new form aimed at considerably increasing the cooperated output of atomic power station equipment.

For this purpose the governments of eight socialist states (Bulgaria, Hungary, the GDR, Poland, Romania, Czechoslovakia, the Soviet Union and Yugoslavia) on June 28, 1979, signed an Agreement on multilateral international specialization and cooperation in production and mutual deliveries of equipment for atomic power stations for the 1981-1990 period. The implementation of the Agreement is assuring successful realization of the resolutions of the congresses of the CMEA member-countries' communist and workers' parties on the development of power engineering, the improvement of the structure of the countries' fuel-energy balances, will create a reliable power supply source and strengthen the socialist community's power engineering base on the whole.

The Multilateral Agreement envisages the manufacture of equipment of over 140 named items in the participating countries (over 350 equipment reference numbers and nearly 300 standard sizes of special nuclear class accessories) for atomic power stations with 440 MW power blocks and for those with 1,000 MW power blocks.

Proceeding from the principles of multilateral international cooperation the countries participating

in the Agreement undertook commitments not only to organize the production of the equipment but also jointly participate in the construction of atomic power stations, fulfil, if necessary, assembly and contract-supervision work on specialized equipment and deliver spare parts for it. These countries place great stress on high quality and reliability of the equipment produced.

During construction of the first power blocks for the atomic power stations in the GDR and Bulgaria, the Soviet Union fulfilled almost the complete volume of design work and supplied all the main and auxiliary equipment. At present the situation has changed substantially. Now formed in the countries are design groups, construction and assembly organizations which thanks to the experience gained in the course of construction of the first atomic power stations' power blocks, fruitful cooperation with the USSR's relevant organizations are capable of accomplishing a substantial portion of this specialized work independently. The volume of work being fulfilled by the socialist countries' organizations independently is increasing every year. This is the direct result of the CMEA member-countries' fraternal cooperation.

The experience gained in building atomic power stations in the USSR and other CMEA member-countries is put to good use when constructing atomic power stations in all countries.

Thus, the steel cells construction method, which reduces working time and raises labour productivity, is widely used when building atomic power stations equipped with VVER-440 reactors.

The on-site flow-line method of constructing atomic power stations' power blocks is being introduced, since, as a rule, several power blocks are constructed in sequence at the same site. Owing to this power blocks are put into operation in shorter time and building machinery, labour and material resources more fully utilized.

Training personnel for servicing atomic power stations is very important. At first personnel received instruction at atomic power stations in the USSR. At present the transfer to an intensified training process using vocational centres equipped with simulators and working models of an atomic power station has

been undertaken thus making the study approximate to actual operating conditions. The key operators for atomic power stations are instructed under unified qualification requirements using identical educational methods.

The Soviet Union's cooperation with other CMEA member-countries in atomic power engineering has markedly progressed. Over a comparatively short historical period the atomic engineering industry in the specializing countries has made a great step forward and gained new advanced positions assuring satisfaction of demands for specialized equipment within the entire coordinated list of atomic power station equipment working with VVER-440 reactor installations.

The further improvement of technical and economic indices of power blocks for atomic power stations with water-moderated reactors is primarily connected with the increase of their unit capacities.

In the Soviet Union the main power block with a VVER-1000 reactor was commissioned at the Novovoronezhskaya atomic power station in 1980. The next power block of similar capacity was put into use at the South Ukrainian atomic power station in 1983. This has made it possible to transfer such atomic power stations to series construction under the standardized design in the Soviet Union. Under this design power blocks for the Zaporozhye and Balakov atomic power stations are being constructed using the flow-line method. Atomic power stations equipped with 1000 MW power blocks are planned to be put into operation in a number of European CMEA member-countries.

We are specially pleased to note that today the CMEA member-countries themselves are capable of solving any questions pertaining to the construction and operation of atomic power stations and do not depend on the capitalist market for the production, delivery, storage and processing of nuclear fuel.

The joint construction of large atomic power stations in the USSR with subsequent feeding of electricity to the countries participating in their construction through the unified Mir (Peace) power system is one of the new forms of the Soviet Union's multilateral cooperation with the European CMEA member-countries in atomic power engineering. The Khmelnitskaya atomic power station (capacity four

million kW) being built with the participation of Hungary, Poland, the USSR and Czechoslovakia is the first such project.

Hungary, the GDR, Poland, the USSR and Czechoslovakia are also participating in constructing the 750kV Khmelnitskaya atomic power station (the USSR)—Rzeszow (Poland) power transmission line for the unified Mir power system. Under the Agreement each participating country will receive power in the quantity proportional to its contribution to the construction. In absolute terms in 1990 annual volumes of power deliveries will amount to: in Hungary 2,400 million kW/h, Poland—6,000 million kW/h and Czechoslovakia—3,600 million kW/h.

Cooperation in utilizing nuclear power for towns' and industrial centres' heat supplies will become one of the promising trends of the Soviet Union's cooperation with the socialist countries in atomic power engineering in the future. An analysis shows that at present in the USSR up to 40 per cent of the total heat-and-electric plants and boiler houses heat supply volume is consumed by industrial and household users. The same can be said about other European CMEA member-countries. That is why practical use of atomic power for power-and-heat supply is a task of primary importance. In the Soviet Union for these purposes unregulated heat extractions from the series atomic power stations are being practised (this idea is being realized for the first time at the Bilibino atomic power station). The construction of the Odessa atomic heat-and-power station has begun and the USSR's first pilot-industrial heat supply atomic stations are being built near Gorky and Voronezh. When sufficient experience is gained and all design solutions are checked at the pilot-industrial installations the objective conditions for wide cooperation in this sphere will be created. Certain steps towards this have already been made. Thus, in cooperation with Soviet organizations the questions of heat supply for the town of Trnava (Czechoslovakia), the Kozloduy settlement (Bulgaria), the Rheinsberg settlement (the GDR) and the town of Paks (Hungary) are being solved using unregulated steam extractions from atomic power stations.

In the CMEA member-countries by now 14 power blocks have been put into use at atomic power stations (total installed capacity nearly 5 million kW).

In *Bulgaria* two stages (comprising four 440 MW power blocks) are successfully operating at the Kozloduy atomic power station. Since the start-up of the first power block (in 1974) the Kozloduy atomic power station has generated nearly 64,000 million kW/h (by the end of 1983). The Kozloduy atomic power station produces almost 30 per cent of Bulgaria's electric power.

The third stage of this atomic power station comprising two 1,000 MW power blocks is under construction. These are the first installations generating millions of kilowatt/hours of power to be commissioned abroad with the Soviet Union's technical assistance.

Preparations are under way for constructing the Belene atomic power station, at first to have two 1 million kW power blocks with future expansion of the capacity up to 4 million kW.

As a result of realization of the programme for constructing atomic power stations in Bulgaria the volume of electric energy generated by atomic power stations will reach 40 per cent of the country's output by 1990.

In the sphere of atomic mechanical engineering Bulgaria, under the multilateral agreement, specializes in manufacturing biological shielding, transport and technological equipment, special pumps and accessories for atomic power stations, etc.

The Soviet Union is rendering technical assistance to *Hungary* in constructing the Paks atomic power station comprising four 440 MW power blocks. This is the first atomic power station being built under the socialist countries' multilateral agreement on cooperation. Czechoslovakia is supplying complete reactor installations, volume compensators, etc., Poland—special heat exchange equipment, the GDR—transport and technological equipment, the USSR—steam generators, turbines, main circulating pumps, etc., Hungarian organizations—re-loaders, special water treatment equipment, 220 MW generators and other equipment.

The first power block at the Paks atomic power station was put into operation in August 1983. The second power block joined the country's electric power grid in September 1984. The remaining power blocks are to be commissioned in 1985 and 1986.

According to Hungarian specialists, with putting the said power blocks into operation the Paks atomic power station will produce one-fourth of the country's electric energy.

Under the multilateral agreement Hungary specializes in manufacturing special water treatment equipment, special machine tools used for repair of major technological equipment, transport and technological equipment, nuclear fuel re-loaders, certain types of electrical engineering items, etc.

The Soviet Union's cooperation with the GDR in atomic power generation began in the mid-1950s when Soviet organizations rendered it technical assistance in constructing the GDR's first Rheinsberg atomic power station (capacity 70 MW). This pilot-industrial atomic power station was commissioned in 1966 and is still successfully operating.

In the 1970s the construction of the Nord atomic power station on the Baltic coast, total capacity 3,520 MW (eight 440 MW power blocks) was started.

The first stage of this atomic power station (power blocks Nos. 1 and 2) was commissioned April 1975, and the second one (power blocks Nos. 3 and 4)—October 1979. All four power blocks of the atomic power station operate with a high rated capacity utilization factor generating nearly 12 per cent of the total GDR's electric energy.

At present two more stages of this atomic power station are under construction. The third and the fourth stages will be completed in 1986-1990.

The USSR also cooperates in constructing in the GDR the Stendal atomic power station comprising two 1 million kW power blocks.

In the atomic mechanical engineering industry the GDR specializes in manufacturing overhead travelling cranes, transport and technological equipment, special bellows accessories, etc.

In April 1983 the *Soviet-Polish* Intergovernmental Agreement was signed on the Soviet Union's technical assistance in constructing the Zarnowiec atomic

power station in Poland (total capacity 1,760 MW) comprising four 440 MW power blocks with Polish turbo-generator sets.

At present the design and construction of the first two power blocks are under way. The Zarnowiec atomic power station is to be commissioned in 1989-1992.

The major technological equipment for the Zarnowiec atomic power station will be supplied by the CMEA member-countries under the multilateral agreement on cooperation dated June 28, 1979. Poland's industry specializing, under the said multilateral agreement, in manufacturing volume compensators, steam generators, separators-steam superheaters, heat exchange equipment, the Seival radiation safety equipment, etc., will widely participate in the manufacture of equipment for this atomic power station.

*Soviet-Romanian* cooperation in constructing an atomic power station in Romania is progressing under the Intergovernmental Agreement signed September 2, 1982, as well as an agreement on international specialization and cooperation in production and mutual deliveries of equipment for atomic power stations.

Soviet organizations render technical assistance in constructing in Romania the first stage of the Moldova atomic power station comprising a one-million kW power block with the VVER-1000 reactor. The agreement envisages expansion of the station up to 3,000 MW. Romania plans to put the first power block into operation in 1990. Equipment for this atomic power station will be supplied by the countries participating in the multilateral agreement. The Soviet Union will deliver a reactor installation as a set, steam generators, technical facilities for technological process automatic control systems, etc. Romania's industry will manufacture equipment for the Moldova atomic power station in which Romania specializes under the multilateral agreement, such as: hydrocapacities for emergency cooling of the reactor zone, GTsN-195M main circulating pumps, an overhead travelling crane for the reactor section (loading capacity 320 tons), overhead travelling cranes for the engine room, etc.

A broad programme for development of atomic

power engineering in close cooperation with the Soviet Union has a substantial place in the undertakings carried out in *Czechoslovakia* for assuring the country's economy with fuel and energy. The annual electric energy output of the atomic power stations will amount to 15,000 million kW/h in 1985 and 30,000 million kW/h in 1990.

At present three large atomic power stations—Bohunice, Dukovany and Mochovce of total capacity 5,280 MW (twelve 440 MW power blocks) are simultaneously being built in *Czechoslovakia*. The construction of these atomic power stations, planned to be completed by 1990, will assure 32 to 34 per cent of the country's total electric energy output. The design work and preparations for the construction of another atomic power station—Temelin (total capacity 4 million kW) comprising VVER-1000 reactor installations are in hand.

To realize the said programme the USSR and *Czechoslovakia*'s governments signed a number of bilateral agreements on cooperation in constructing specific atomic power stations as well as the Programme of USSR-*Czechoslovakia* cooperation in developing atomic power engineering in *Czechoslovakia* up to 1990.

As a result of Soviet and Czechoslovak specialists' fruitful cooperation in 1980 the first stage of the Bohunice atomic power station (two 440 MW power blocks) was completed and now produces nearly seven per cent of *Czechoslovakia*'s electric energy. The third power block of this atomic power station was put in operation in August 1984. The first power block of the Dukovany atomic power station is soon to be completed.

USSR-*Czechoslovakia* cooperation in the atomic power mechanical engineering industry has a special nature since *Czechoslovakia* is a country with a traditionally well developed machine-building industry and highly skilled engineering and technical specialists.

Today, *Czechoslovakia* is included in the list of the world's ten countries manufacturing complete reactor installations. *Czechoslovakia*'s industry turns out almost all major and auxiliary equipment for first and second loops of atomic power stations with VVER-440 reactor installations. At present it is



starting to manufacture equipment for atomic power stations with VVER-1000 reactor installations. The first reactor body is planned to be constructed by 1987.

*Yugoslavia* is also a participant in the agreement on multilateral specialization and cooperation in production of equipment for atomic power stations. It specializes in manufacturing equipment for atomic power stations having the RBMK-1000 reactor installations being built in the Soviet Union (steam separators, collectors and pipelines). In addition, *Yugoslavia's* industry specializes in manufacturing certain types of pumping equipment and special accessories.

The Soviet Union is rendering technical assistance to the *Republic of Cuba* in the construction of the 880 MW Juragua atomic power station comprising two power blocks with VVER-440 reactor installations. The said atomic power station is being constructed to an individual design which takes into account the specific conditions of the building site, such as highly humid tropical climate; the region's high rated seismicity, equipment's operation at the frequency 60 Hz, cooling with sea water, etc. The Juragua atomic power station is at present under construction.

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At the Summit Economic Conference held in Moscow last June much attention was given to further development of the CMEA member-countries' cooperation in solution of the fuel and energy problem.

In the Conference's decisions a task was set to change the structure of energy production and to expand the CMEA countries' cooperation in the field of the predominant development of atomic

power generation. It was planned to work out a programme by the CMEA member-countries to build atomic power stations and atomic heat-supply stations up to the year 2000.

Thus the socialist countries' cooperation in the field of atomic power generation enters a new stage—the stage of wide-scale construction of atomic power stations. The volumes of Soviet technical assistance rendered to the socialist countries in building atomic power stations in the next five-year plan period will more than double the previous one.

Such large-scale cooperation undertaken by the CMEA member-countries in manufacturing equipment has been never achieved in world practice before; they mastered production of the specialized equipment. Realization of the programme for construction of atomic power stations is of great economic and political significance demonstrating in practice the undeniable advantage of socialism.

The experience of international economic and technical cooperation in atomic power engineering witnesses the high vitality of socialist internationalism and tremendous potentials of all the interested countries' united efforts aimed at solving large-scale economic problems.



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GENERAL

NEFTEGAZ-84 EXHIBIT REVIEWED

Moscow APN DAILY REVIEW in English 4 Dec 84 p 4

["Text" of article by V. Chebakov, PRAVDA, 4 December 1984: "Oil Equipment for Land and Sea Operations"]

[Text] The international exhibition "Neftegaz-84" is closing today in the exhibition centre on the Krasnopresnenskaya Embankment in Moscow. More than 300 companies and organizations from 17 countries have taken part in the exhibition.

Our country is among the world leaders in oil and gas production. Oil derricks look habitual today not only on land and in the Caspian Sea, but are pushing ahead onto the continental shelf of our Far Eastern and Arctic seas, too. This explains the interest of Soviet experts in the latest developments in this field by advanced capitalist countries with many of which the Soviet Union is successfully cooperating.

Over the past few decades the Finnish company Vartsila has built 467 ships of various types for our country, and this cooperation successfully continues to the present day. In the past two or three years the ship-builders from Turku have delivered to the USSR the specialized "Sprut" vessel for underwater operations, two ice-strengthened salvage tugs, two passenger ships, four supply ships for offshore geological exploration teams, and floating cranes of the catamaran type with a load capacity of 600 tons. Next year the Finnish ship-builders will launch another such crane with a load capacity of 1,600 tons.

"In building ships for the USSR," said company representative Captain Krister Gorschelnik, "we use a large number of Soviet-made machines and equipment. We are working in close contact with the Sudoimport association and with the USSR Ministry of the Gas Industry. At the moment, our engineers are offering interesting ship designs for auxiliary operations in offshore oil prospecting and drilling in the Arctic seas."

Two years ago a big drilling platform capsized and sank near Newfoundland. More than 80 people died in the cold northern waters. That tragedy provided a strong impetus for the development of special clothes protecting people from freezing in ice-cold water. The Canadian company Fitzright Suits has brought samples of such suits to Moscow.

"They are made of neoprene," said Brian Zintek, vice-president of the company, "a soft fabric designed on the basis of natural rubber and a number of synthetic components. In such a suit a man can survive for six hours in ice-cold water. Today all sailors, helicopter crews, drilling platform workers and people of many other trades associated with northern seas are issued such clothes. We are glad that Soviet experts have shown interest in our products."

Thousands of various machines have been supplied to the USSR by the American company Caterpillar Overseas C.A. These include tractors, excavators, heavy-duty trucks, scrapers, all-terrain vehicles and so on.

"Over the past ten years," said the head of the company's Moscow branch, Paul Smith, "our engineers have designed and developed a new generation of machines of modular design. With unchanged capacity, their efficiency has grown by 30 per cent. Our bulldozers and pipe-layers can operate under the most trying offroad conditions and in 50-degree frosts. Heavy-duty D-10 bulldozers from this new generation are already operating in the Magadan region, while our latest development, the Caterpillar-591 pipelayer with a lifting capacity of 158 tons is designed for the construction of main oil and gas pipelines."

For decades now our country has been fruitfully cooperating with the Austrian company VEW which manufactures various top-grade steel products. At the latest exhibition company experts have exhibited their main products: a wide range of heavy-duty CBC oil-drilling equipment, including weighted non-magnetic pipes for offshore drilling operations, locks for drilling pipes, mechanical handling tools, lifting appliances and many other articles.

The exhibition "Neftegaz-84" will certainly contribute to further progress in the field of mineral exploration and production.

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